

NAUGATUCK VALLEY COUNCIL OF GOVERNMENTS

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CT Route 229 Corridor Study



PREPARED & PRESENTED BY

BL Companies, Inc.

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INTRODUCTION

The Naugatuck Valley Council of Governments (NVCOG), the Town of Southington and City of Bristol, in cooperation with the Connecticut Department of Transportation (CTDOT) and Capitol Region Council of Governments (CRCOG), have initiated the CT Route 229 Corridor Study (the Study) to evaluate existing challenges and opportunities throughout the Study Area. The purpose of this study is to conduct a comprehensive transportation plan for CT Route 229 (West Street, Middle Street, and King Street) and prepare conceptual engineering drawings for spot improvements along the length of the corridor that will address congestion and safety while providing for improved pedestrian, bicycle, and transit-user accessibility. The comprehensive plan, will:

- address safety, congestion, and mobility of the transit system, pedestrians, and bicyclists
- assess travel demand growth and its impacts on area roadways including traffic associated with development within the Study Area, and
- develop recommendations that provide transportation system enhancements and economic growth opportunities.

The study process includes six primary work tasks that were included in the overall scope of the Project:

- TASK 1 – Project Management
- TASK 2 – Public Outreach and Engagement
- TASK 3 – Data Collection and Analysis of Existing Conditions
- TASK 4 – Alternative Analysis
- TASK 5 – Future Development
- TASK 6 – Report Preparation

Study Area

The Study Area includes the corridor along CT Route 229 in Southington and Bristol from the I-84 Interchange 31 in the Town of Southington, northerly, to the Farmington Avenue intersection in the City of Bristol, a distance of approximately six (6) miles. CT Route 229 through the project limits is also known as West Street, Middle Street, and King Street. These three segments are defined as follows:

- Southern Segment - West Street: from the southern limits of the corridor northerly to its intersection with the southern ESPN Drive, CT Route 229 is known as West Street.
- Central Segment - Middle Street: from southern ESPN Drive northerly to the Riverside Avenue intersection, CT Route 229 is known as Middle Street.
- Northern Segment - King Street: from Riverside Avenue northerly to intersection with Farmington Avenue, CT Route 229 is known as King Street.

The Study Area limits and street names are shown in [Figure 1](#). The Study includes the assessment of intersecting side street approaches, as well as access and egress for

adjacent land uses. The CT Route 229 corridor is intersected by access points to Lake Compounce, ESPN, residential streets, business parks, and many local businesses. There are also many local destinations on or adjacent to CT Route 229 such as schools, restaurants, farms, retail, and grocery stores. CT Route 229 is not served directly by local fixed-route bus service; however, bus services are provided along CT Route 72, which crosses CT Route 229. Similarly, there are limited amenities for bicyclists and pedestrians.



Figure 1 CT Route 229 Corridor Study Project Limits and Street Names

Study Team

The study team includes representatives from the Town of Southington, City of Bristol, NVCOG, CRCOG, CTDOT in addition to the consultant team. The consultant team is led by BL Companies with The Williams Group as subconsultant.

BL Companies is the prime consultant on the project and is responsible for providing overall project management, traffic and transportation engineering, assessment of the existing natural resources and review of current transportation infrastructure relative to accommodations for bicycles and pedestrians, providing recommendations for future enhancements to better accommodate all modes of travel in the Study Area, and leading the public involvement process. The Williams Group is responsible for assessment of economic, demographic, and real estate market to perform a market analysis real estate development trends. Public and community input was also considered in the market assessment to understand economic and quality of life impacts.

The CTDOT Bureau of Policy and Planning is actively involved in the Study through their participation on the Public Advisory Committee. In addition to that role, they also serve as a liaison between the Study Team and the other CTDOT departments.

The study's overall project manager is NVCOG. NVCOG staff lead the public outreach initiatives in cooperation with the Town of Southington and the City of Bristol. Staff from NVCOG are members on the Public Advisory Committee. Additionally, NVCOG hosts the project website. Going forward, NVCOG will assist the City of Bristol and work with the

CTDOT to identify and securing funding for projects based on the recommendations of this Study. The CRCOG will perform this same role for the Town of Southington.

The study's comprehensive and cooperative approach ensures that the planning activities are consistent with the overall planning goals at all levels of government and correlate with the collective vision for the Study Area. A summary of the Study Team and the public involvement process is presented in [Figure 2](#).



Figure 2 Study Team and Public Involvement Process

Study Process

To understand the issues facing the corridor and to produce the recommendations of the study, the project team has conducted an assessment of existing transportation, land use, economic and environmental conditions to identify projected needs, deficiencies, and opportunities. Key elements include:

- Observing traffic volumes by segment and intersection, vehicle classifications, travel speeds within the Study Area
- Developing 2020 Existing Traffic volumes

- Analyzing traffic safety using a Connecticut Crash Data Repository (CTCDR)
- Analyzing traffic operations during the AM, Mid-day, and PM peak hour
- Reviewing current multi-modal transportation services and facilities
- Identifying natural and environmental resources

These analyses will form the basis for the development of a series of improvement alternatives in Tasks 4 and 5 of the study. This effort will include:

- Conduct technical analyses of all modes of travel (vehicular, transit, and active transportation), while identifying themes in regard to safety, complete streets, and emerging technologies.
- Forecasting future travel demand, analyzing future traffic conditions, and identifying potential future areas of concern.
- Identify potential economic development opportunities in the corridor and assess their potential effect on the transportation system.
- Identify feasible infrastructure improvement alternatives that could mitigate the effects of future traffic on the corridor while providing opportunities to enhance the overall transportation system to better accommodate all modes of travel.
- Conduct stakeholder meetings to obtain input on the study findings and to help guide the development of improvement alternatives.
- Conduct a comprehensive public outreach process involving meetings and a project website to obtain public input on the study process and recommendations that can be supported in the long-range transportation plan.

Ultimately, the Study will result in a comprehensive Transportation Improvement and Development Management Plan for CT Route 229.

Stakeholders

CT Route 229 Corridor Study included a significant stakeholder outreach effort that was designed to gather input from a wide range of corridor stakeholders with interests across all modes of transportation.

The outreach process included the following components:

- One-on-one and small group stakeholder meetings were held with representatives from the two communities including local businesses in the study corridor and local economic development representatives. Summary of the meeting is included in [Appendix J](#)
- Public Advisory Committee (PAC) – the PAC included NVCOG, CRCOG, CTDOT, City of Bristol and Town of Southington. This group have met several times to review study processes, interim findings and deliverables, and make recommendations as the study progressed.
- On-line and in-person survey – a survey instrument was developed and circulated to gather opinions of corridor users and interested parties regarding current transportation conditions as well as questions to gauge the types of proposed improvements.

- Direct public outreach – the project team will be hosting public meeting to provide information on the CT Route 229 Corridor as well as to gather information and feedback from local residents.
- Other outreach materials including project fact sheets, news briefs, and a project website were developed to provide information and to assist in the outreach to the interested communities.

Using these combined outreach strategies, the team was able to obtain opinions regarding current transportation issues as well as ideas for project improvement recommendations as well as to inform the community about the study area. The information will be used in the development of the final project ideas and improvement scenarios.

Public Involvement and Outreach Initiatives

Community involvement and public outreach were important initiatives of this study scope. A variety of techniques and methods were used to inform the public of study findings and to obtain feedback from project stakeholders throughout the study process.

Residents and businesses in the study area had ample opportunities to monitor the progress of the study and offer input to the Study Team to help inform the decisions and recommendations of the Study. Throughout the Study, a comprehensive public Outreach Program was conducted by the Study Team in cooperation with the State and Local agencies. The goals of the community involvement and public outreach program included:

- Obtaining input from the public and project stakeholders on study area issues and concerns to help identify and frame the study goals and objectives
- Advising the public on the study findings
- Involving stakeholders and the public in the development and refinement of recommendations that fit the character and future vision of the Towns
- Facilitating reviews by the Town Councils, Boards, and Commissions as well as Businesses and Residents leading to a Final Improvement Plan that is endorsed by the Towns and Region to help guide future transportation system improvements and enhancements

In order to meet these public Involvement and Outreach goals, the project committees outlined in the following section were formed.

Goals and Objectives

The study goals and objectives outlined below were developed with input from the Advisory Committee and reflect the overall desire for a safe and efficient transportation system that will support and promote the economic viability of the CT Route 229 Corridor.

The corridor recommendations will be developed to both satisfy these goals and respond to the key issues and areas of concern identified in following chapters.

Goal: Improve Corridor Safety for All Users

Objectives:

- Address safety concerns and deficiencies in high accident locations and other areas of concern.
- Provide measures to manage vehicular speeds, particularly in areas of existing and future development nodes.
- Manage vehicular access to minimize conflicts on CT Route 229.
- Provide measures to promote safe use of corridor by pedestrians and bicyclists.

Goal: Improve Mobility and Accessibility for All Users

Objectives:

- Mitigate traffic delays along CT Route 229.
- Improve side road access to and from CT Route 229.
- Provide new and improved pedestrian facilities (where appropriate) to promote walkability within development nodes.
- Provide new and improved bicycle facilities (where appropriate) to promote bike ability in the corridor and to improve bike access to the South Mountain Trail, Park & Ride lots, and other destinations.
- Provide improved multimodal access for Park & Ride lots and public transit services; examine opportunities for other Park & Ride lot and transit service improvements.

Goal: Coordinate Land Use and Transportation Strategies and Recommendations

Objectives:

- Develop transportation recommendations and promote land use strategies based on smart growth principles that provide compact development, incorporate mixed uses, and facilitate transportation choices.
- Support future economic development opportunities and associated transportation needs.

Goal: Coordinate Land Use and Transportation Strategies and Recommendations

Objectives:

- Develop strategies and recommendations that are consistent with the existing rural, small community characteristics of the corridor.
- Minimize impacts to historic, environmental, and visual resources.

EXISTING CONDITIONS ASSESSMENT

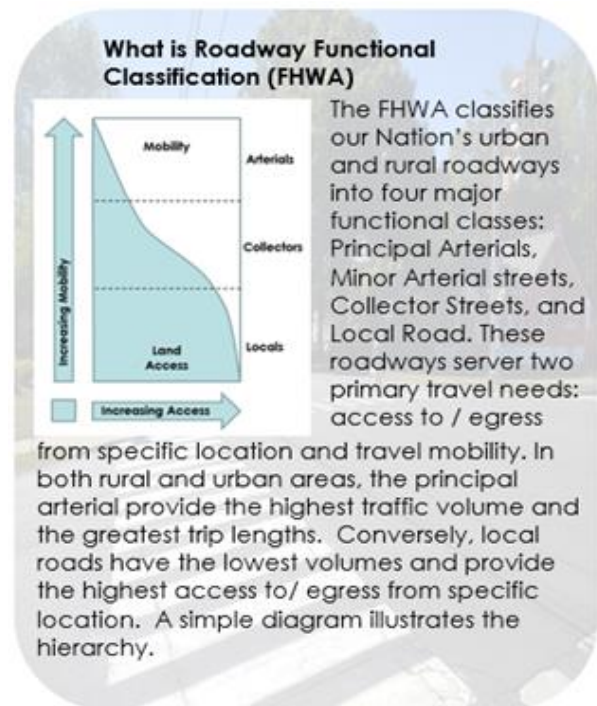
The assessment of existing conditions includes an extensive data collection process to establish the current condition of the transportation system in the Study Area and identify existing needs and deficiencies, as well as opportunities for improvement. This section describes the assessment of the Study Area transportation system as it exists in 2020. This report provides an assessment of the CT Route 229 Study Area relative to the existing roadway and traffic; land use and development; pedestrian, bicyclist, and vulnerable user; and commuter systems.

Stakeholder input is a key component of the data collection process to help complete the existing conditions assessment. The purpose of the existing conditions assessment is to identify deficiencies in order to establish a baseline against which future conditions and improvement recommendations can be evaluated.

Roadway and Traffic

This section identifies and evaluates the issues, deficiencies, and opportunities of the existing roadway system within the Study Area. It is important to note that the roadway system is part of the overall CT Route 229 transportation system, other elements of which are assessed in the following sections.

Based on the classifications of the Study Area roadways, a review of roadway characteristics was conducted to determine where deficiencies exist. The following sections summarize the results.



Roadway Characteristics

CT Route 229 is classified as "principal arterial other" by the CTDOT with variable posted speeds along its length. The corridor was grouped into three segments as shown in [Figure 3](#).

Southern Segment CT Route 229 is known as West Street from the southern limits of the corridor at Interstate 84 interchange 31 westbound ramps northerly to its intersection with the southern ESPN Drive. Segment 1 consists of ten signalized and five non-signalized intersections, with a posted speed limit of 40 mph. The roadway cross section varies with the

addition of exclusive turn lanes at major signalized intersections. In the northbound direction there are two through lanes while southbound consists of one through lane from ESPN Drive intersection until North Executive Blvd intersection and two through lanes from North Executive Blvd until the project limits at the I-84 Westbound ramps.

Central Segment CT Route 229 is known as Middle Street from the southern ESPN Drive northerly to the Riverside Avenue intersection. Similarly, the roadway cross section varies with the addition of exclusive turn lanes at major signalized intersections, however both northbound and southbound directions have two thru lanes. A posted speed limit of 40 mph is observed until Battista Road at Business Park Road intersection. Continuing northerly the posted speed limit is 35 mph.

Northern Segment CT Route 229 is known as King Street from Riverside Avenue northerly to its intersection with Farmington Avenue. The roadway cross section north of Broad Street consists primarily of one thru lane per direction with addition of exclusive turn lanes at West Washington Avenue. This section operates with a posted speed limit of 30 mph from Broad Street to the project limits at US Route 6 / Farmington Avenue. Between Riverside Avenue and Broad Street, CT Route 229 carries two thru lanes in each direction with exclusive left-turn lanes.

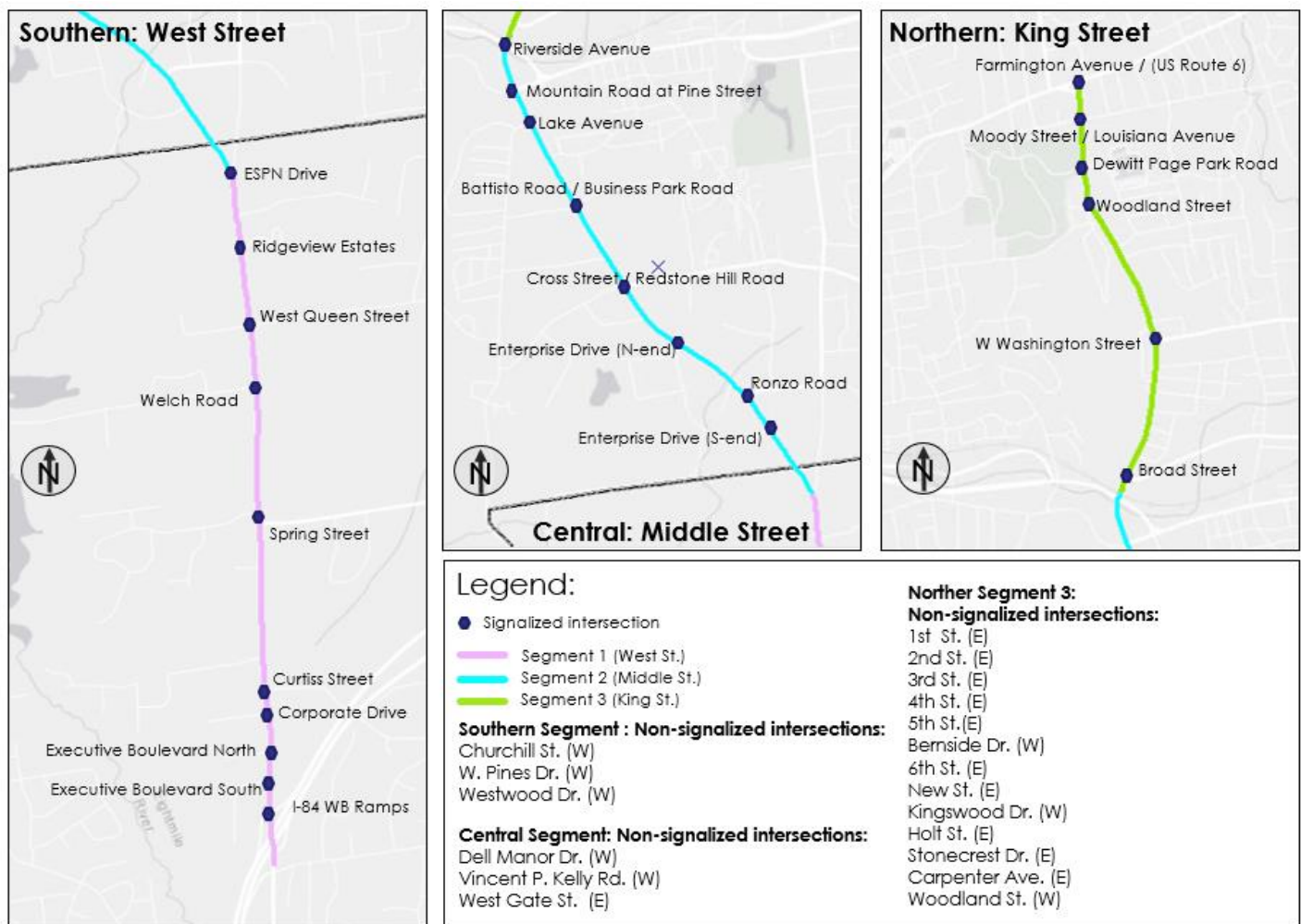


Figure 3 Study Area Three segments with Signalized intersection locations.

Intersection Traffic Control

Table 1 through **Table 3** provide a summary of roadway characteristics organized by intersection. Information includes – number of lanes (through, exclusive left / right or shared), type of control (signalized or non-signalized), and speed (posted / average / 85th percentile). Similarly, **Assessment 1** through **Assessment 24** provides detailed information for all twenty-four (24) signalized intersections and six (6) non-signalized intersections with geometrical deficiencies. The assessment sheets also include multimodal details such as sidewalk, crosswalk, and the presence of accessible pedestrian ramps, and crash data information.

Major roadways in the vicinity of the project include I-84, US Route 6, CT Route 72 / Pine Street, West Washington Street, West Queen Street and Lake Street.

I-84 extends from Dunmore, Pennsylvania to Sturbridge, Massachusetts. Through Connecticut I-84 intersects with other interstates: I-691, I-91, I-291, and I-384 in Connecticut and I-90 / Massachusetts Turnpike in Massachusetts. Along most of its length through Connecticut and near the project area, I-84 has three through travel lanes in the eastbound and westbound directions. The average daily traffic in 2019, provided by CTDOT, ranges from 45,500 vehicles per direction just east of CT Route 229 (West Street) to 40,600 vehicles in eastbound direction and 49,000 in westbound direction west of CT Route 229 intersection. The speed limit is 65 mph.



Photo 1 Intersection with I-84 Westbound Ramps Interchange 31

US Route 6 / Farmington Avenue is classified as principal arterial other by CTDOT and runs east-west in the state of Connecticut, from the New York state line in Danbury to the Rhode Island state line in Killingly. Within the study area, Farmington Avenue has an eastbound through and right turn lane and in westbound direction through and left turn lane. The 2019 average annual daily traffic is 28,200 vehicles east of its intersection with CT Route 229.



Photo 2 Intersection with US 6 / Farmington Avenue

West Washington Street is a minor arterial in the City of Bristol, with one travel lane in each direction for its entire length from CT Route 229 to Camp Street where it connects to CT Route 177. The average daily traffic provided by CTDOT was estimated at 5,400 vehicles in 2015 with posted speed limit of 30 mph. West Washington Street serves as an east-west connector for residential neighborhoods.



Photo 3 Intersection with West Washington Street

West Queen Street is classified as urban major collector by CTDOT with east – west directionality. West Queen Street extends from Depaolo Drive to CT Route 10 / Queen St in Southington. West of CT Route 229, the roadway has one through lane in each direction and to the east of this intersection West Queen Street carries one lane in the eastbound direction and two lanes in the westbound direction. The posted speed limit is 35 mph with average daily traffic of 6,300 vehicles in 2015, the most recent year available. West Queen Street provides access to residential neighborhoods, farmland, and industrial developments.



Photo 4 Intersection with West Queen Street

Lake Avenue is classified as minor arterial with one travel lane in both the northbound and southbound directions. It extends from CT Route 229 in the vicinity of Casey Field, past Lake Compounce to Welch Road where in Southington it continues as Mt. Vernon Road. This roadway provides an alternative route to I-84 and I-691 ramps. The posted speed limit is 30 mph with traffic volume of 3,400 vehicles daily in 2019.



Photo 5 Intersection with Lake Avenue

CT Route 72 is classified as principal arterial other and provides the City of Bristol and rural communities to the north and west with a connection to I-84 and points east. CT Route 72 enters Bristol as a four-lane median separated principal arterial (East Bartlett Barnes Highway) at the Plainville Town Line in the vicinity of the Route 72 freeway. It eventually transitions to a four-lane undivided roadway and follows Pine Street to Riverside Avenue. In 2010, Route 72 was rerouted in Plainville and Bristol onto the new four-lane widened Pine Street, and an extended section of Riverside Avenue that crosses the Pequabuck River. The overlap with CT Route 229 was eliminated, and the old sections along Broad Street, Central St, and East Main Street were decommissioned as a state-maintained facilities and control of maintenance transferred to the City.



Photo 6 Intersection with CT Route 72 Extension and Riverside Avenue



Photo 7 Intersection with Pine Street and Mountain Road.

CT Route 229: West Street Segment

Table 1: Southern Segment: West Street intersection roadway geometry

Crossing Road	Signalized (Yes/No)	Type of Int.	Northbound # Lanes	Southbound # Lanes	Eastbound # Lanes	Westbound # Lanes	Percent Heavy Vehicles	Posted Speed to the north of intersection (mph)	Design Speed / 85% North of the Intersection	Average Speed North of the Intersection
I -84 WB ramps	Yes	4 leg	2 thru, 1 exclusive left	2 thru, exclusive right	1 thru, exclusive left, exclusive right	-	10.3	40	42	34
Executive Boulevard South	Yes	T / 3-leg	2 thru, 2 exclusive left	2 thru, exclusive right	exclusive Left, exclusive 2 right	-	10.3	40	42	34
Executive Boulevard North	Yes	T / 3-leg	2 thru, 1 exclusive left	2 thru/shared right	exclusive Left, exclusive right	-	10.3	40	42	34
Corporate Drive	Yes	4 leg	2 thru, 1 exclusive left	1 thru/right, 1 exclusive left	shared thru	1 thru/right, 1 exclusive left	10.3	40	42	34
Curtiss Street	Yes	T / 3-leg	2 thru/shared right	one lane for all movements	-	one lane for all movements	6.9	40	45	38
Churchill Street	No	T / 3-leg	2 thru	shared thru	1 In - no outlet	-		40		
Summers Hill Drive	No	T / 3-leg	2 thru	shared thru	1 In - no outlet	-		40		
Spring Street	Yes	T / 3-leg	2 thru, shared right	1 thru/right, 1 exclusive left	-	exclusive right, exclusive left	6.9	40	45	38
W. Pine Drive	No	T / 3-leg	2 thru	shared thru	shared thru	-		40		
Welch Road	Yes	4 leg	2 thru, shared left	shared thru	shared thru	1 thru (Private Driveway)	6.9	40	45	38
West Queen Street	Yes	4 leg	2 thru/shared right, 1 exclusive left	1 thru/right, 1 exclusive left	shared thru	shared thru right, exclusive left	8.9	40	46	36
Ridgeview Estates at Cumberland Farms Gas Station	Yes	4 leg	2 thru/shared right, 1 exclusive left	1 thru/right, 1 exclusive left	1 thru/right, 1 exclusive left	1 thru/right, 1 exclusive left	8.9	40	46	36
Westwood Road	No	4 leg	2 thru	shared thru	1 thru (Private Driveway)	shared thru		40		
Seneca Road	No	T / 3-leg	2 thru	shared thru		1 thru (Private Driveway)		40		
ESPN Drive	Yes	T / 3-leg	2 thru, 1 exclusive right	2 thru, exclusive left	-	exclusive right, exclusive left	8.9	40	46	36

CT Route 229: Middle Street Segment

Table 2: Central Segment: Middle Street intersection roadway geometry

Crossing Road	Signalized (Yes/No)	Type of Int.	Northbound # Lanes	Southbound # Lanes	Eastbound # Lanes	Westbound # Lanes	Percent Heavy Vehicles	Posted Speed to the north of intersection (mph)	Design Speed / 85% North of the Intersection	Average Speed North of the Intersection
ESPN Drive	Yes	T / 3-leg	2 thru, exclusive right	2 thru, exclusive left	-	exclusive right, exclusive left	8.9	40	46	36
Enterprise Drive (S-end)	Yes	T / 3-leg	2 thru, exclusive left	2 thru/shared right, 1 exclusive left	exclusive right, exclusive left	-	8.9	40	46	36
Ronzo Road	Yes	4 leg	2 thru, exclusive left	2 thru, 1 exclusive left, 1 exclusive right	1 thru (Private Driveway)	1 thru/left, 1 exclusive right	8.9	40	46	36
Dell Manor Drive	No	4 leg	2 thru, shared left/right	2 thru, shared left/right	shared thru	shared thru		40		
Enterprise Drive (N-end)	Yes	4 leg	2 thru, shared left/right	2 thru, shared left/right	1 thru/right, 1 exclusive left	1 thru (Private Driveway)	8.6	40	52	42
Pine Brook Terrace	No	T / 3-leg	2 thru, shared left/right	2 thru, shared left/right	shared thru	-		40		
Cross Street at Redstone Hill Road	Yes	4 leg	2 thru/shared right, 1 exclusive left	2 thru/shared right, 1 exclusive left	1 thru/right, 1 exclusive left	1 thru/right, 1 exclusive left	8.6	40	52	42
Vincent P Kelly Road	No	T / 3-leg	2 thru	2 thru	shared thru	-		40		
Battisto Road at Business Park Road	Yes	4 leg	2 thru/shared right, 1 exclusive left	2 thru/shared right, 1 exclusive left	1 thru/right, 1 exclusive left	one lane for all movements	10.5	40	48	39
West Gate Street	No	T / 3-leg	2 thru/shared right	2 thru/shared left	shared thru	-		30		
Lake Avenue at Terry Commons	Yes	4 leg	2 thru/shared right, 1 exclusive left	2 thru/shared right, 1 exclusive left	1 thru/left, 1 exclusive right	1 thru/shared right/left, 1 exclusive left	10.5	30	48	39
Mountain Road at Pine Street	Yes	4 leg	2 thru/shared right, 1 exclusive left	2 thru/shared right, 1 exclusive left	2 thru/shared right, 1 exclusive left	2 thru/shared right, 1 exclusive left	12.6	30	43	34

CT Route 229: King Street Segment

Table 3: Northern Segment: King Street intersection roadway geometry

Crossing Road	Signalized (Yes/No)	Type of Int.	Northbound # Lanes	Southbound # Lanes	Eastbound # Lanes	Westbound # Lanes	Percent Heavy Vehicles	Posted Speed to the north of intersection (mph)	Design Speed / 85% North of the intersection	Average Speed North of the Intersection
Riverside Avenue / CT Route 72	Yes	4 leg	2 thru/shared right, 1 exclusive left	2 thru, 1 exclusive left, 1 exclusive right	1 thru, 2 exclusive left, 1 exclusive right	2 thru, 1 exclusive left, 1 exclusive right	8.8	30	35	28
Broad Street	Yes	T / 3-leg	2 thru, 1 exclusive right	2 thru, 1 exclusive left, 1 exclusive right	-	2 exclusive left, 1 exclusive right	5.1	30	42	35
First Street	No	T / 3-leg	shared thru	shared thru	-	shared thru		35		
Second Street	No	T / 3-leg	shared thru	shared thru	-	shared thru		35		
Third Street	No	T / 3-leg	shared thru	shared thru	-	shared thru		35		
Fourth Street	No	T / 3-leg	shared thru	shared thru	-	shared thru		35		
Fifth Street	No	T / 3-leg	shared thru	shared thru	-	shared thru		35		
Burnside Drive	No	T / 3-leg	shared thru	shared thru	shared thru	-		35		
Sixth Street	No	T / 3-leg	shared thru	shared thru	-	shared thru		35		
New Street	No	T / 3-leg	shared thru	shared thru	-	shared thru		35		
W. Washington Street	Yes	4 leg	shared thru	1 thru/shared right, 1 exclusive left		shared thru	3.6	35	43	36
Kingswood Drive	No	T / 3-leg	shared thru	shared thru	shared thru	-		35		
Holt Street	No	T / 3-leg	shared thru	shared thru	-	shared thru		35		
Stonecrest Drive	No	T / 3-leg	shared thru	shared thru	-	shared thru		35		
Carpenter Avenue	No	T / 3-leg	shared thru	shared thru	-	shared thru		35		
Woodland Street	Yes	T / 3-leg	shared thru	shared thru	shared thru	-	3.3	35	43	36
Dewitt Page Park Road	Yes	4 leg	shared thru	shared thru	shared thru	shared thru	3.5	35	46	39
Moody Street at Louisiana Avenue	Yes	4 leg	shared thru	shared thru	shared thru	shared thru	3.5	35	46	39
Farmington Avenue (US Route 6)	Yes	4 leg	1 thru, 1 exclusive left, 1 exclusive right	shared thru	1 thru/shared right 1 thru/shared /left	1 thru/shared right 1 thru/shared /left	3.4	35	35	36



Route 229 (King Street) at US Route 6 (Farmington Avenue)

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-209
- Signalized Intersection (Route 6 Coordinated Signal System), Four-Legged Intersection
- Emergency Vehicle Pre-Emption All Approaches
- No Turn On Red for the Westbound Approach
- Side Street Green Pedestrian Crossing Timing
- No Pedestrian Crosswalk
- Pedestrian Push Buttons on the Eastern Corners with Ramps
- Sidewalk on Both Sides of the Roadway
- NB Approach: One Exclusive Left Turn Lane, Shared Through-Left Turn Lane, One Exclusive Right
- SB Approach: One Shared Lane for All Movements
- EB Approach: One Shared Through-Left Lane, One Shared Through-Right Lane
- WB Approach: One Shared Through-Left Lane, One Shared Through-Right Lane



OTHER OBSERVATIONS

- In 3 years: 21 Collisions, 43% Angle Crash Type, 1 suspected serious injury
- Dunkin Donuts located on Eastern Side
- Gas Station located on Western Side
- Route 229 northbound queues during the p.m. peak period extends close to the southerly signalized intersection of Route 229 and Louisiana Avenue/Moody Street and it affects traffic operation at this downstream intersection.
- Pedestrian Amenities should be upgraded.



Route 229 (King Street) at Moody Street / Louisiana Avenue

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-208
- Signalized Intersection (Time Based Coordinated Signal System), Four-Legged Intersection, No Emergency Vehicle Pre-Emption
- Exclusive Pedestrian Crossing Timing
- Pedestrian Crosswalks at all 4 legs
- Pedestrian Push Buttons and Ramps at each Intersection Corner
- NB Approach: One shared lane for all movements
- SB Approach: One shared lane for all movements
- EB Approach: One shared lane for all movements
- WB Approach: One shared lane for all movements

OTHER OBSERVATIONS

- In 3 years: 26 Collisions, 54% Angle Crash Type, and 1 fatal injury
- Grace Baptist Church Located on Southern Side





Route 229 (King Street) at Dewitt Page Park Road

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-207
- Signalized Intersection (Time Based Coordination Signal System), Four-Legged Intersection, No Emergency Vehicle Pre-Emption Exclusive Pedestrian Crossing Timing
- Pedestrian Crosswalk at the Northern Side of the Intersection
- Pedestrian Push Buttons on the Northern Corners with Ramps
- NB Approach: One shared lane for all movements
- SB Approach: One shared lane for all movements
- EB Approach: One shared lane for all movements
- WB Approach: One shared lane for all movements

OTHER OBSERVATIONS

- In 3 years: 7 Collisions, 43% Angle Crash Type and 2 crashes with suspected minor injury
- Dewitt Page Park located on Western Side
- Bristol Eastern High School located on Eastern Side
- Athletic Fields located on both sides of the Intersection





Route 229 (King Street) at Woodland Street

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-206
- Signalized Intersection (Time Based Coordination Signal System), Three-Legged / T Intersection
- Exclusive Pedestrian Crossing Timing
- Pedestrian Crosswalks at the Northern Side of the Intersection
- Pedestrian Push Buttons Located at Northern Corners
- NB Approach: One shared lane for all movements
- SB Approach: One shared lane for all movements
- EB Approach: One shared lane for all movements



OTHER OBSERVATIONS

- Second crosswalk at Karen Road
- Steep grade at Woodland Street approach
- Low accident rate at the intersection
- Wide shoulder on the east side of CT Route 229.





Route 229 (King Street) at West Washington Street

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-259
- Signalized Intersection, Three-Legged / T Intersection, No Emergency Vehicle Pre-Emption
- Exclusive Pedestrian Crossing Timing
- Pedestrian Crosswalk at Southbound Approach
- Pedestrian Push Buttons on the Northern and Eastern Corners
- Pedestrian sidewalk on the eastside of CT Route 229 and northern side of W. Washington Street
- Handicap ramps non-ADA compliant
- NB Approach: One shared lane for all movements
- SB Approach: One through lane, One exclusive left turn lane
- WB Approach: One shared lane for all movements



OTHER OBSERVATIONS

- In 3 years: 17 Collisions, 53% Front to Rear Crash Type
- Shoulder on the west side of CT Route 229 narrows near intersection to accommodate left turn lane.





Route 229 (King Street) at Broad Street

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-269
- Signalized Intersection (Route 72 Coordinated Signal System), Three-Legged / T Intersection
- Emergency Vehicle Pre-Emption All Approaches
- Side Street Green Pedestrian Crossing Timing
- Pedestrian Crosswalk on the Eastern Side
- Pedestrian Push Button on both sides of CT Route 229
- NB Approach: Two through lanes, One exclusive channelized right turn lane
- SB Approach: Two through lanes and one exclusive left turn lane
- WB Approach: Two Exclusive left turn lanes and One exclusive right turn lane



OTHER OBSERVATIONS

- In 3 years: 11 Collisions, 36% Front to Rear Crash Type
- North of the intersection the northbound through two lanes merge to one lane.
- Shoulder width limited to 1-2 ft
- North of the intersection posted speed limit of 35mph





Route 229 (King Street) at Route 72 / Riverside Avenue

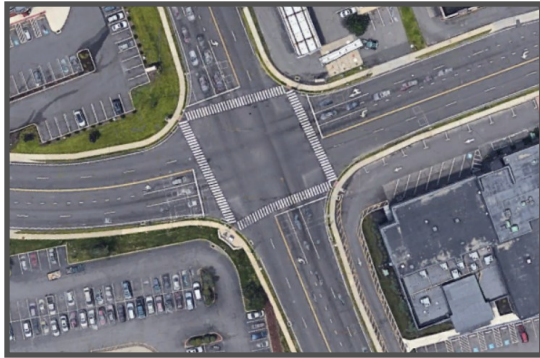
INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-204
- Signalized Intersection (Route 72 Coordinated Signal System), Four-Legged Intersection
- Emergency Vehicle Pre-Emption All Approaches
- Side Street Green Pedestrian Crossing Timing
- Pedestrian Crosswalk on the Southern and Eastern Sides
- Pedestrian Push Buttons on the Southern Corners with Ramps
- NB Approach: One through, one shared through right turn lanes, one exclusive left turn lane
- SB Approach: Two through lanes, one exclusive right turn lane, One Exclusive left turn lane
- EB Approach: One through lane, two exclusive left lanes, one exclusive right turn lane
- WB Approach: Two through lanes, one exclusive right turn lane, one exclusive left turn lane



OTHER OBSERVATIONS

- In 3 years: 80 Collisions, 56% Front to Rear crash type, 10 Suspected minor injuries
- CTrail viaduct to the north of the intersection
- The Middle Street Dam is located at the southwest corner carrying Pequabuck River



Route 229 (Middle Street) at Mountain Road/ Pine Street

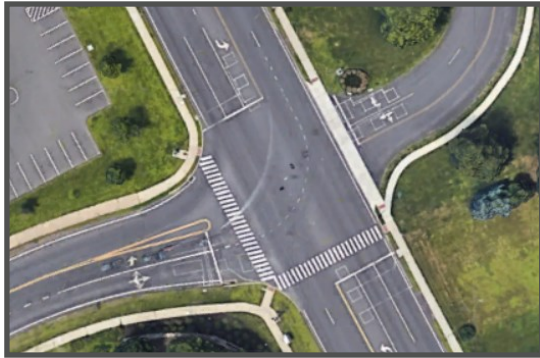
INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-201
- Signalized Intersection (Route 72 Coordinated Signal System), Four-Legged Intersection
- Emergency Vehicle Pre-Emption All Approaches
- Exclusive Pedestrian Crossing Timing
- Pedestrian Crosswalks at each Intersection Leg
- Pedestrian Push Buttons at each Intersection Corner with Ramps
- NB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- SB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- EB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- WB Approach: One through lane, one shared through-right lane, one exclusive left turn lane



OTHER OBSERVATIONS

- In 3 years: 181 Collisions, 41% Angle Crash Type with 3 Suspected Serious Injuries
- Shell Gas Station and Hartford HealthCare Medical Group located on Eastern Side
- CVS and Grocery Store located on Western Side
- CTtransit Routes 102 and 502 stops near the intersection
- Steep grade on Mountain Road approach



Route 229 (Middle) at Lake Avenue / Terry Commons

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

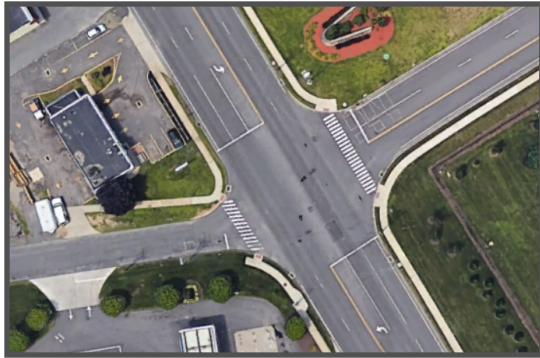
- CTDOT Signal #017-261
- Signalized Intersection (Route 72 Coordinated Signal System), Four-Legged Intersection
- Emergency Vehicle Pre-Emption for Route 229 Approaches
- Exclusive Pedestrian Crossing Timing
- Pedestrian Crosswalks on the Southern and Eastern Sides of Intersection
- Pedestrian Push Buttons on the Southern and Eastern Corners with Ramps
- NB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- SB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- EB Approach: One shared through-right-left lane and one exclusive left turn lane
- WB Approach: One shared through-left lane and One Exclusive right turn lane



OTHER OBSERVATIONS

- In 3 years: 20 Collisions, 45% Angle Crash Type
- Park and Ride Lot on the northeast corner of the intersection
- Casey Field on the southeast corner of the intersection
- Terry Commons on the east side of the intersection





Route 229 (Middle Street) at Battisto Road / Business Park Road

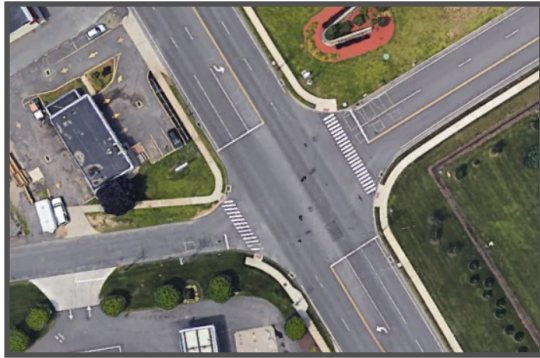
INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-258
- Signalized Intersection (Route 229 Coordinated Signal System), Four-Legged Intersection
- Emergency Vehicle Pre-Emption for Route 229 Approaches
- Side Street Green Pedestrian Crossing Timing
- Pedestrian Crosswalks at Eastern and Western Approaches
- Pedestrian Push Buttons only on the southern side of the intersection crossings
- All four corners have ADA compliant ramps and 5ft wide sidewalks
- NB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- SB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- EB Approach: One shared lane for all movements
- WB Approach: One shared through-right lane, one exclusive left turn lane



OTHER OBSERVATIONS

- In 3 years: 8 Collisions, 38% Front to Rear, 38% Angle, and 63% of collisions resulted in No Apparent Injury
- Entrance to Business Park on eastern side



Route 229 (Middle Street) at Battisto Road / Business Park Road

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-258
- Signalized Intersection (Route 229 Coordinated Signal System), Four-Legged Intersection
- Emergency Vehicle Pre-Emption for Route 229 Approaches
- Side Street Green Pedestrian Crossing Timing
- Pedestrian Crosswalks at Eastern and Western Approaches
- Pedestrian Push Buttons only on the southern side of the intersection crossings
- All four corners have ADA compliant ramps and 5ft wide sidewalks
- NB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- SB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- EB Approach: One shared lane for all movements
- WB Approach: One shared through-right lane, one exclusive left turn lane



OTHER OBSERVATIONS

- In 3 years: 8 Collisions, 38% Front to Rear, 38% Angle, and 63% of collisions resulted in No Apparent Injury
- Entrance to Business Park on eastern side



Route 229 (Middle Street) at Cross Street / Redstone Hill Road

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-221
- Signalized Intersection (Route 229 Coordinated Signal System), Four-Legged Intersection
- Emergency Vehicle Pre-Emption for all Route 229 Approaches
- Side Street Green Pedestrian Crossing Timing
- No Pedestrian Crosswalks
- Pedestrian Push Buttons only on the southern side of the intersection crossings
- All four corners have ADA compliant ramps and 5ft wide sidewalks
- NB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- SB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- EB Approach: One shared through-right lane, one exclusive left turn lane
- WB Approach: One shared through-right turn lane, one exclusive left turn lane



OTHER OBSERVATIONS

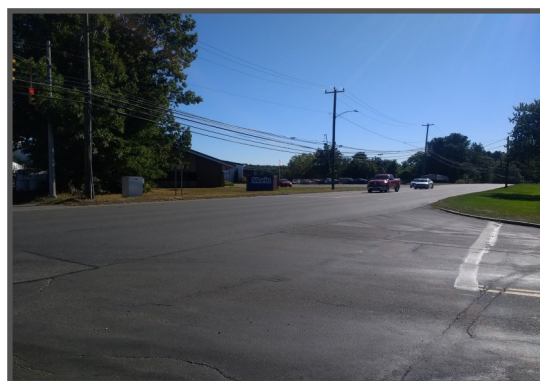
- In 3 years: 23 Collisions, 61% Angle Crash Type, and 2 suspected serious injuries
- Restaurant and ESPN Parking Lot located on northern side
- Gas Station Located on southern corner



Route 229 (Middle Street) at Enterprise Drive (North)

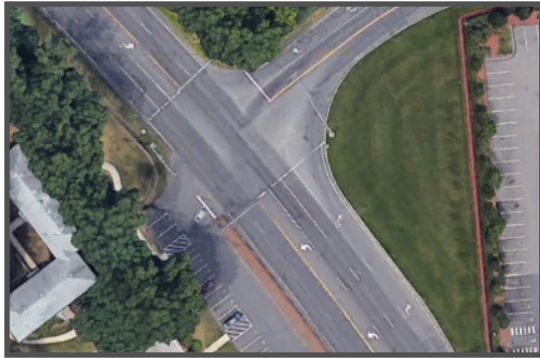
INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-260
- Signalized Intersection (Route 229 Coordinated Signal System), Three-Legged / T Intersection
- Emergency Vehicle Pre-Emption for Route 229 Approaches
- No Pedestrian Crosswalk
- Pedestrian Push Buttons on the Northern Corners with a Ramp on the Northeast Corner
- Limited sidewalk of Enterprise Drive and southeast corner of Middle Street
- NB Approach: One shared through-left turn lane, one shared through-right turn lane
- SB Approach: One shared through-left turn lane, one shared through-right turn lane,
- EB Approach: One shared through-right lane, one exclusive left turn lane
- WB Approach: One shared lane for all movements (Private Drive)



OTHER OBSERVATIONS

- In 3 years: 5 Collisions, 40% Front to Rear Crash Type
- On the eastern side of the intersection there is American Gas Company
- On the western side of the intersection there is the entrance to Technology Park which includes Double Tree by Hilton



Route 229 (Middle Street) at Ronzo Road

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-267
- Signalized Intersection (Route 229 Coordinated Signal System), Four-Legged Intersection
- Emergency Vehicle Pre-Emption for All Route 229 Approaches
- Side Street Green Pedestrian Crossing Timing
- No Pedestrian Crosswalks
- Pedestrian Push Button at the Southeast Corner
- NB Approach: Two through lanes, one exclusive left turn lane, one exclusive right turn lane
- SB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- EB Approach: One shared lane for all movements
- WB Approach: one shared through-left lane, one exclusive right turn lane



OTHER OBSERVATIONS

- In 3 years: 12 Collisions, 75% Angle Crash Type with 2 suspected minor injuries
- Residential units on the east side
- Southeast corner delineates ESPN campus

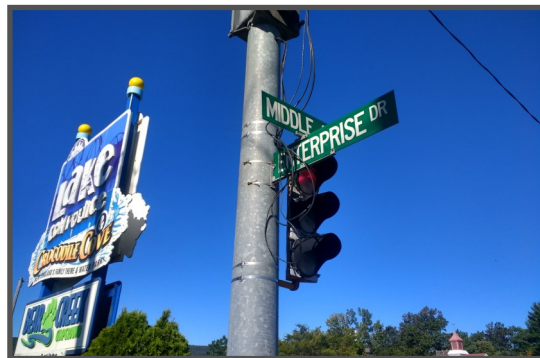




Route 229 (Middle Street) at Enterprise Drive (South)

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #017-255
- Signalized Intersection (Route 229 Coordinated Signal System), T/ Three-Legged Intersection
- Emergency Vehicle Pre-Emption for All Route 229 Approaches
- Side Street Green Pedestrian Crossing Timing
- No Pedestrian Crosswalk
- Pedestrian Push Buttons on the Southern Corners and continuous sidewalk on the eastside
- NB Approach: Two through lanes, one exclusive left turn lane.
- SB Approach: One through lane, one shared through-right lane,
- EB Approach: One Exclusive Right Turn Lane, One Exclusive Left Turn Lane



OTHER OBSERVATIONS

- In 3 Years: 10 Collisions, 50% Front to Rear Crash Type with 1 suspected minor injury
- Entrance to Technology Park located on the Eastern Side of the Intersection
- Entrance to Lake Compounce





Route 229 (Middle Street) at ESPN Drive

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #131-254
- Signalized Intersection (Route 229 Coordinated Signal System), Three Legged / T Intersection
- Emergency Vehicle Pre-Emption for All Route 229 Approaches
- Side Street Green Pedestrian Crossing Timing
- No Pedestrian Crosswalk
- Pedestrian Push Button on the Northeastern Corner with Ramps
- Sidewalk present on the North east side of the intersection in front of ESPN Campus.
- NB Approach: Two through lanes, one exclusive right turn lane
- SB Approach: Two through lanes, one exclusive left turn lane
- WB Approach: One exclusive right turn lane, one exclusive left turn lane

OTHER OBSERVATIONS

- In 3 years: 6 Collisions, 33% Front to Rear Crash Type and 1 crash with suspected serious injury

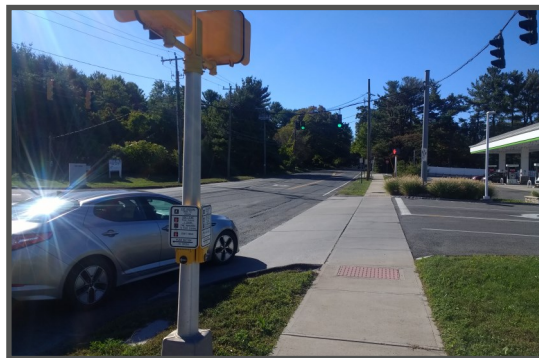




Route 229 (West Street) at Ridgeview Estates / Cumberland Farms

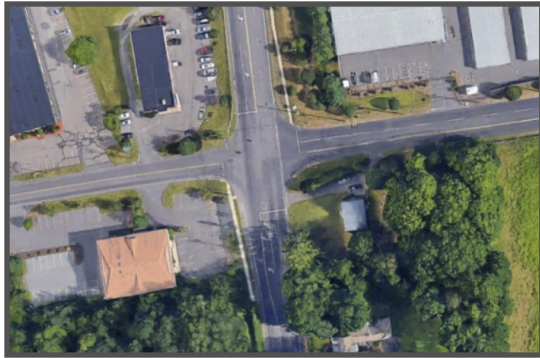
INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal # 131-264
- Signalized Intersection (Route 229 Coordinated Signal System), Four-Legged Intersection
- Emergency Vehicle Pre-Emption for All Route 229 Approaches
- Pedestrian crosswalk to the north of the intersection
- Pedestrian Push Buttons on the Northern corners with ramps
- NB Approach: One exclusive left turn lane, one through lane, shared through-right lane,
- SB Approach: One shared through-right lane, one exclusive left turn lane
- EB Approach: One shared through-right lane, one exclusive left turn lane
- WB Approach: One shared through-right lane, one exclusive left turn lane



OTHER OBSERVATIONS

- In 3 years: 4 collisions, 75% Front to Rear
- Cumberland Farms located on the western side
- Housing Development located on the eastern side
- Sidewalk only present in front of Cumberland Farms development



Route 229 (West Street) at West Queen Street

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal # 131-225
- Signalized Intersection Four-Legged Intersection
- No Pedestrian Crosswalk
- Pedestrian Push Buttons on the Southern Corners
- Sidewalk present on the North east side and South west corners of the roadway
- NB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- SB Approach: One shared through-right lane, one exclusive left turn lane
- EB Approach: One shared lane for all movements
- WB Approach: One shared through-right lane, one exclusive left turn lane



OTHER OBSERVATIONS

- In 3 years: 44 Collisions, 52% Front to Rear Crash Type with 1 fatal injury and 1 suspected of serious injury. The fatal crash was caused by a vehicle that crossed the center line and hit the oncoming vehicle head-on
- Steep grade on West Queen Street approach and CT Route 229 has rolling hill terrain





Route 229 (West Street) at Welch Road

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #131-253
- Signalized Intersection, Three-Legged / T Intersection
- No Pedestrian Crosswalk
- Pedestrian Push Buttons on the Southern Corners
- Sidewalk present on the southeast corner of the roadway
- NB Approach: One through lane, one shared through-left lane
- SB Approach: One shared lane for all movements
- EB Approach: One shared lane for all movements
- WB Approach: One shared lane for all movements (private access point)



OTHER OBSERVATIONS

- In 3 years: 5 Collisions, 80% Front to Rear Crash Type with 2 suspected minor injuries
- On the west side of the intersection two developments present: Highland Golf Range and Geremia Gardens





Route 229 (West Street) at Spring Street

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #131-251
- Signalized Intersection, Three - Legged / T Intersection
- Side Street Green Pedestrian Crossing Timing
- No Pedestrian crosswalk or sidewalks
- Pedestrian Push Buttons on the Northern Corners
- NB Approach: One through lane, one shared through-right lane,
- SB Approach: One through lane, one exclusive left turn lane
- WB Approach: One exclusive right turn lane, one exclusive left turn lane



OTHER OBSERVATIONS

- In 3 years: 22 Collisions, 45% Front to Rear Crash Type with 2 suspected minor injuries
- On the northeast corner the Central Christian Academy is located
- On the southeast corner The Tabernacle Christian Church is located
- 200 ft to the north of the intersection, unsignalized W. Pine Road intersection is located





Route 229 (West Street) at Curtiss Street

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #131-263
- Signalized Intersection, Three - Legged / T Intersection
- Emergency Vehicle Pre-Emption for All Route 229 Approaches
- Side Street Green Pedestrian Crossing Timing
- No Pedestrian Crosswalk and sidewalk only present at the southeast corner
- Pedestrian Push Buttons on the Northwest and Southeast Corners
- NB Approach: One through lane, one shared through-right lane
- SB Approach: One lane for all movements
- WB Approach: One lane for all movements



OTHER OBSERVATIONS

- In 3 years: 28 Collisions, 43% Front to Rear Crash Type
- Youth Learning Center is located on the eastern side of the intersection
- 600 ft to the north of the intersection unsignalized Churchill Road intersection is located





Route 229 (West Street) at Corporate Drive

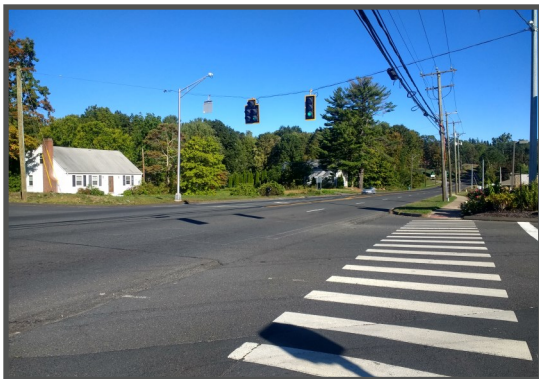
INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal #131-268
- Signalized Intersection (Temporary Coordinated Signal System), Four-Legged Intersection
- Emergency Vehicle Pre-Emption for All Route 229 Approaches
- Side Street Green Pedestrian Crossing Timing
- Pedestrian Crosswalks on the Eastern and Southern Sides of the Intersection
- Pedestrian Push Buttons on the Southern Corners with Ramps
- NB Approach: One through lane, one shared through-right lane, one exclusive left turn lane
- SB Approach: One shared through-right lane, one exclusive left turn lane
- EB Approach: One lane for all movements
- WB Approach: One shared through-right lane, one exclusive left turn lane



OTHER OBSERVATIONS

- In 3 years: 3 Collisions, 100% Angle Crash Type
- Dunkin Donuts and Homewood Suites by Hilton on the western side
- Centurion Plaza on the eastern side





Route 229 (West Street) at Executive Boulevard (North)

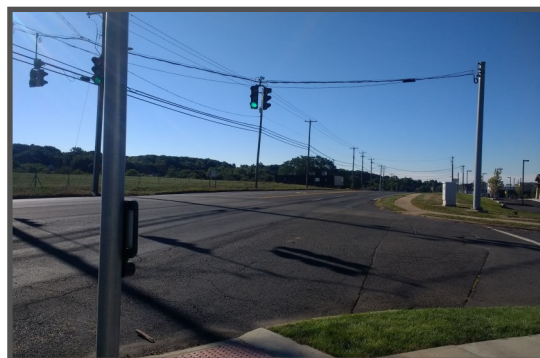
INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal # 131-255
- Signalized Intersection (Time Based Coordinated Signal System), 3 - Legged / T Intersection
- Emergency Vehicle Pre-Emption for All Route 229 Approaches
- Side Street Green Pedestrian Crossing Timing
- No Pedestrian Crosswalk
- Pedestrian Push Buttons on the Northeastern and Southwest Corners
- Handicap ramps on the Western side of the roadway with 5ft wide sidewalks
- NB Approach: Two through lanes, one exclusive left turn lane
- SB Approach: One through lane, one shared through-right lane
- EB Approach: One exclusive left turn lane, one exclusive right turn lane



OTHER OBSERVATIONS

- In 3 years: 17 Collisions, 71% Front to Rear Crash Type
- Corporate Office and retail space located on the eastern side
- Open space on the western side

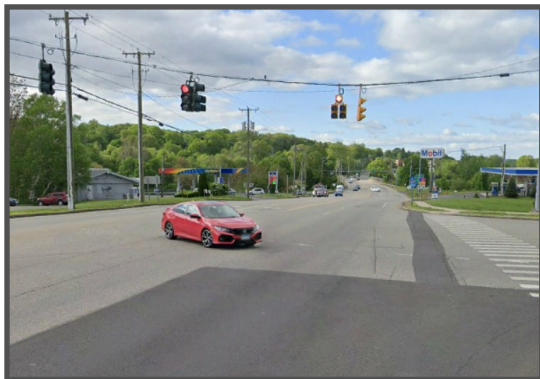




Route 229 (West Street) at Executive Boulevard (South)

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal # 131-248
- Signalized Intersection (Time Based Coordinated Signal System), T/ 3 Legged Intersection
- Emergency Vehicle Pre-Emption for All Route 229 Approaches
- Side Street Green Pedestrian Crossing Timing
- Pedestrian Crosswalk located on Eastern Side
- Pedestrian Push Buttons on the Northern Corners and ADA compliant Ramps on the Eastern Corners
- NB Approach: Two through lane, two exclusive left turn lanes
- SB Approach: Two through lanes, one exclusive right turn lane
- EB Approach: Exclusive left turn lane, two exclusive right turn lanes



OTHER OBSERVATIONS

- In 3 years: 23 Collisions, 61% Front to Rear Crash Type
- Entrance to Retail Plaza Located on western side





Route 229 (West Street) at I-84 Westbound Ramps

INTERSECTION CHARACTERISTICS & MULTI-MODAL FEATURES

- CTDOT Signal # 131-232
- Signalized Intersection (Time Based Coordinated Signal System), Four-Legged Intersection
- Emergency Vehicle Pre-Emption for All Route 229 Approaches
- No Pedestrian Crosswalk
- No Pedestrian Push Buttons or Handicap Ramps
- NB Approach: Two through lanes, one exclusive left turn lane
- SB Approach: Two through lanes, one exclusive right turn lane
- WB Approach: One exclusive left turn lane, one shared through-left lane, one channelized right turn lane



OTHER OBSERVATIONS

- In 3 years: 34 Collisions, 43% Angle Crash Type with 4 crashes identified with suspected minor injuries





Route 229 (King Street) at Woodland Street

INTERSECTION CHARACTERISTICS

- Unsignalized Intersection, Three-Legged / T Intersection
- NB Approach: One Lane for All Movements,
- SB Approach: One Lane for All Movements
- EB Approach: One Lane for All Movements, stop controlled

OTHER OBSERVATIONS

- 85% speed: 40 mph
- Design SSD: 305 ft Observed SSD: 385 ft
- Design ISD : 445 ft
- Observed ISD - Right: 385 ft (vertical grade & shrubs in the way)
- Observed ISD - Left: +600 ft (into next intersection)
- Sight line issues



Route 229 (West Street) at Churchill Street

INTERSECTION CHARACTERISTICS

- Unsignalized Intersection, Three-Legged/ T Intersection
- NB Approach: Two Through Travel Lanes
- SB Approach: One Through Travel Lane
- EB Approach: One Lane for All Movements, stopped controlled

OTHER OBSERVATIONS

- 85% speed: 55 mph
- Design SSD: 495 ft Observed SSD: 530 ft
- Design ISD : 610 ft
- Observed ISD - Right: 700 ft vertical grade
- Observed ISD - Left: +700 ft vertical grade and trees / shrubs in the way
- Sight line issues, crest curve





Route 229 (Middle Street) at Dell Manor Drive INTERSECTION CHARACTERISTICS

- Unsignalized Intersection, Three- Legged / T Intersection
- NB Approach: Two Through Travel Lanes
- SB Approach: Two Through Travel Lane
- EB Approach: One Lane for All Movements, stopped controlled

OTHER OBSERVATIONS

- 85% speed: 50 mph
- Design SSD: 425 ft Observed SSD: 300 ft
- Design ISD : 555 ft
- Observed ISD - Right: 300 ft
- Observed ISD - Left: 300 ft
- Sight line issues from both directions due to vertical grade and shrubs



Route 229 (West Street) at Westwood Road INTERSECTION CHARACTERISTICS

- Unsignalized Intersection, Three- Legged / T Intersection
- NB Approach: Two Through Travel Lanes
- SB Approach: One Through Travel Lane
- WB Approach: One Lane for All Movements, stopped controlled

OTHER OBSERVATIONS

- 85% speed: 50 mph
- Design SSD: 425 ft Observed SSD: 385 ft
- Design ISD : 555 ft
- Observed ISD - Right: 385 ft
- Observed ISD - Left: 385 ft
- Sight line issues from both directions due to vertical grade and shrubs/trees obstructing view





Route 229 (Middle Street) at Vincent P. Kelly Drive

INTERSECTION CHARACTERISTICS Unsignalized Intersection, Three- Legged / T Intersection

- NB Approach: Two Through Travel Lanes
- SB Approach: Two Through Travel Lane
- EB Approach: One Lane for All Movements, stopped controlled

OTHER OBSERVATIONS

- 85% speed: 50 mph
- Design SSD: 425 ft Observed SSD: +600 ft
- Design ISD : 555 ft
- Observed ISD - Right: +1,000 ft (into next intersection)
- Observed ISD - Left: +600 ft (into next intersection)
- No sight line issues



Route 229 (West Street) at Sommers Hill Drive

INTERSECTION CHARACTERISTICS

- Unsignalized Intersection, Three- Legged / T Intersection
- NB Approach: Two Through Travel Lanes
- SB Approach: One Through Travel Lane
- EB Approach: One Lane for All Movements, stopped controlled

OTHER OBSERVATIONS

- 85% speed: 55 mph
- Design SSD: 495 ft Observed SSD: 460 ft
- Design ISD : 610 ft
- Observed ISD - Right: 460 ft vertical grade
- Observed ISD - Left: +700 ft vertical grade & shrubs in the way.
- Sight line issues, sag curve



Roadway Standards

This section presents the design standards for CT Route 229. According to the CTDOT Highway Design Manual (HDM) 2013 Edition the following conditions apply:

- Principal Arterial Other roadway functional classification
- Intermediate environment

The posted speed limit in the Study Area varies between 30 mph and 40 mph. From the southern limits of the corridor at Interstate 84 westbound ramps northerly to the intersection with Battista Road / Business Park Road the posted speed limit is 40 mph. Following northerly, just north of the CT Route 229 (Middle St) at Battista Road / Business Park Road intersection to Broad Street the posted speed limit is 30 mph. Lastly, between Broad Street and Farmington Avenue, the CT Route 229 posted speed limit is 35 mph.

With different posted speed limits, the design speed will vary. Design speed is used in selecting the vertical and horizontal requirements for evaluation of roadways while speed limits are based on a statistical analysis of individual vehicular speeds. The design standards for CT Route 229 are shown in [Table 4](#).

Average travel speeds on CT Route 229 are generally five miles per hour over the posted speed limit for both northbound and southbound. The 85th percentile speeds (the speed at which 85 percent of traffic at or below) are between five and ten miles per hour above the speed limit. Traffic tends to travel faster in the northbound direction. The likely reason for this trend is that the roadway is wider with more dedicated through lanes for longer stretches thus allowing for the passing of slower vehicles in the Study Area.

What is Design Speed?

AASHTO states "the maximum safe speed that can be maintained over a specified section of highway when conditions are so favorable that the design features of the highway govern."

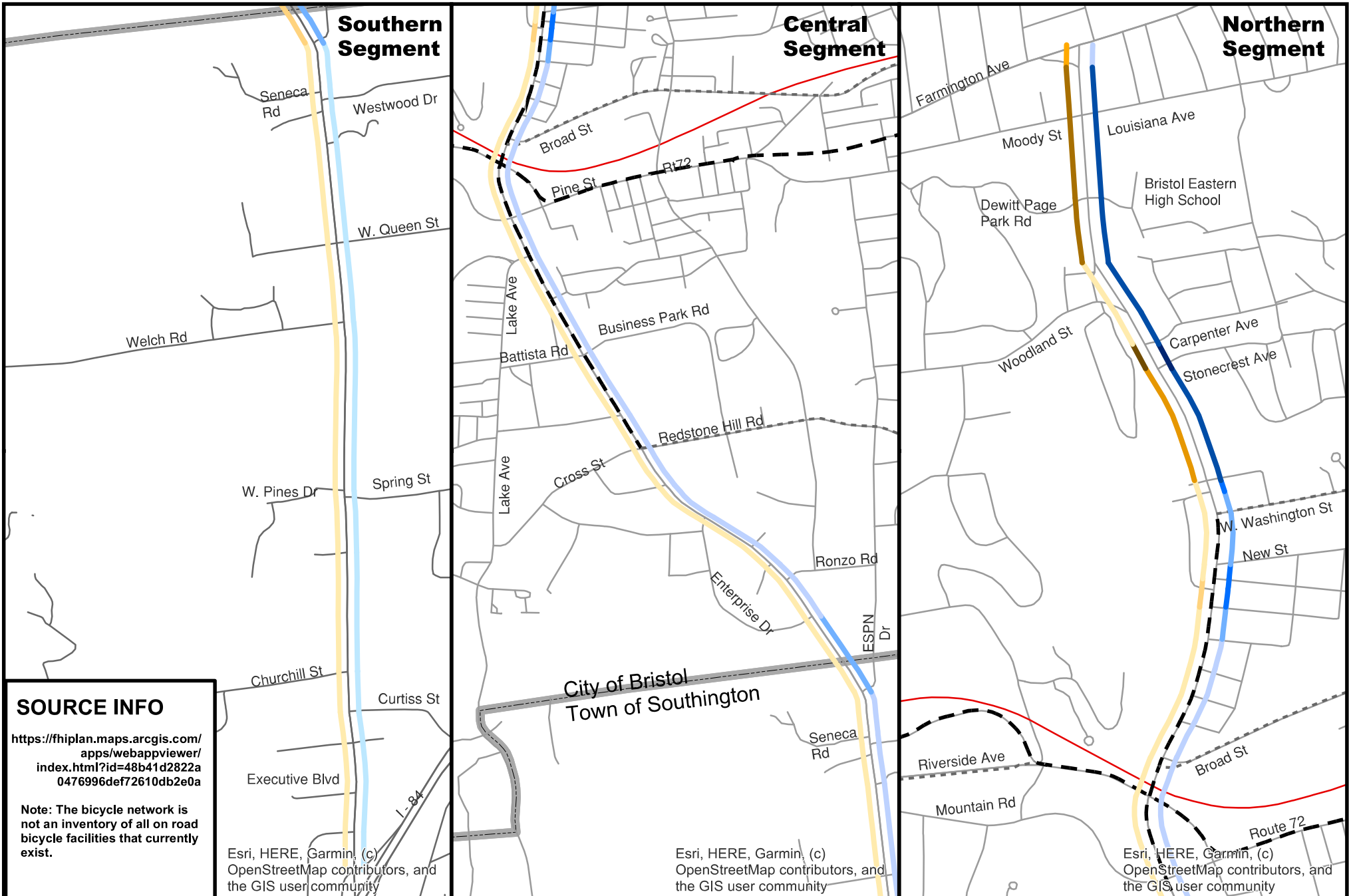
Table 4: Principal Arterial Design Standards

Design Element	Design Standards			
	(35 mph)	(40 mph)	(45 mph)	(50 mph)
Through Lane Width	11'-12'	11'-12'	11'-12'	11'-12'
Shoulder Width	2'-6'	4'-8'	4'-8'	4'-8'
Sidewalk Width	5'	5'	5'	5'
Bicycle Lane Width	5'	5'	5'	5'
Stopping Sight Distance	250'	305'	360'	425'
B1 - Left Turn Intersection Sight Distance	390'	445'	500'	555'
B2 - Right Turn Intersection Sight Distance	335'	385'	430'	480'

Horizontal curvature of a road affects a driver's ability to see far enough to be able to stop safely to avoid a collision. Curves can also contribute to a loss of control of a vehicle if speed limits are significantly exceeded. The CTDOT Design Manual indicates that a stopping sight distance of 425 feet is required for level surfaces with a posted speed limit of 45 mph (design speed of 50 mph). Some side streets have deficient intersection sight distance due to landscaping or terrain obstructing sight lines.

Summary and direction of deficiency is provided in [Table 5](#) while [Figure 4](#) illustrates the shoulder widths along the CT Route 229 corridor. Steep grades can present safety and operational challenges by restricting sight lines and increasing the distance a vehicle needs to safely stop. During inclement weather, steep grades can also contribute to the loss of traction between a vehicle's tires and the pavement surface. The CTDOT Highway Design Manual suggests that a 7% grade should be considered the maximum for an arterial. CT Route 229 is located on rolling terrain with slopes that do not exceeding the 7%.

- Between Curtiss St & Spring St (up to 6% grade of 300' or longer)
- Between West St and Enterprise Drive (North-end) with up to 5.5% grade



SOURCE INFO

<https://fhiplan.maps.arcgis.com/apps/webappviewer/index.html?id=48b41d2822a0476996def72610db2e0a>

Note: The bicycle network is not an inventory of all on road bicycle facilities that currently exist.

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

LEGEND	Right Shoulder	Left Shoulder	Bike Lanes
	1-2ft	1-2ft	State Road
	2-4ft	2-4ft	Town Road
	4-6ft	3-4ft	CT Rail
	5-6ft	5-6ft	CT Roads
	6-8ft	6-8ft	Town Boundary
	7-8ft	7-8ft	

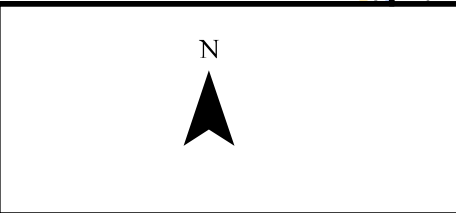


Figure 4
CT ROUTE 229 CORRIDOR STUDY
BRISTOL / SOUTHINGTON

Left and Right Shoulder Width (ft)

Architecture Engineering Environmental Land Surveying Companies

Table 5: Summary of Existing Geometric Deficiencies

Existing Feature / Location	Existing Value (approx.)	Design Standard Value	Comments
Shoulder Width			
Northern Segment: Between W. Washington St and Broad St.	2'-6'	4'-8'	Shoulder width are substandard especially near intersections to accommodate pass-by vehicles.
Central Segment: Between West Gate St and ESPN Dr	1'-3'	4'-8'	Shoulder width are substandard to accommodate the additional width of 2 lanes in each direction.
Southern Segment: between ESPN Dr and Spring St	1'-3'	4'-8'	Shoulder width are substandard for higher speed segment 45-50 mph.
Sidewalk Width / Presence			
Northern Segment	0 ft - 5 ft	5ft min.	Some sidewalk is present on both sides of the roadway but is discontinuous.
Central Segment	0 ft - 5 ft	5ft min.	Some sidewalk is present on both sides of the roadway but is discontinuous.
Southern Segment	0 ft - 5 ft	5ft min.	Only around newer commercial developments sidewalk is present. There is no sidewalk on the eastern side of the road.
Bike Lane Width / Presence			
Northern Segment	0 ft	Sealed shoulder	Currently there are no bike lanes, dedicated bike routes, signage, or facilities for bicyclists along CT Route 229
Central Segment	0 ft	Sealed shoulder / cycle path	
Southern Segment	0 ft	Cycle path	
Stopping Sight Distance			
West St at Westwood Dr	425 ft	~ 385 ft	The sight distance is restricted by vegetation
Middle St at Dell Manor Dr	425 ft	~ 300 ft	At 300 ft next signalized intersection is present. Shrubs / trees obstruct view of EB traffic.
King St at Woodland St	305 ft	~ 400 ft	At 400 ft grade and poles obstruct the view. In addition, shrubs / trees obstruct view of EB traffic.

Design Intersection Sight Distance (ISD): Left Turn – B1 / Right Turn – B2			
West St at Sommers Hill Dr	555 ft	~ 460 ft	Due to grade view of the roadway is restricted.
West St at Westwood Dr	555 ft	~ 385 ft	The sight distance is restricted by Vegetation.
Middle St at Dell Manor Dr	555 ft	~ 300 ft	At 300 ft next signalized intersection is present. Shrubs / trees obstruct view of EB traffic.
King St at Woodland St	445 ft	~ 400 ft	At 400 ft grade and poles obstruct the view. In addition, shrubs / trees obstruct view of EB traffic.
Note: CTDOT Highway Design Manual utilizes the higher value (B1) for both intersection sight distances as design standard.			

Traffic Conditions

The existing traffic conditions assessment includes measures of traffic volumes, travel speeds, travel time, and traffic operations. These measures are used to quantify and evaluate trends and identify deficiencies. On State roadways, CTDOT collects traffic data approximately every three to four years and estimates the annual average daily traffic (AADT). These data are collected using automatic traffic recorders (ATR), typically on a 48-hour basis. The most recent counts on CT Route 229 were conducted in 2020. It should be noted that due to the ongoing Coronavirus pandemic, traffic volumes from 2020 onwards needed to be adjusted and verified by the CTDOT Bureau of Policy and Planning. The historical ADT volumes are presented in [Figure 5](#) and [Table 6](#) below.

What is Average Daily Traffic (ADT)?

ADT is the sum of two-way traffic volume passing through a specific perpendicular line on the roadway in a 24-hour period. ADT is measured in vehicles per day (vpd).

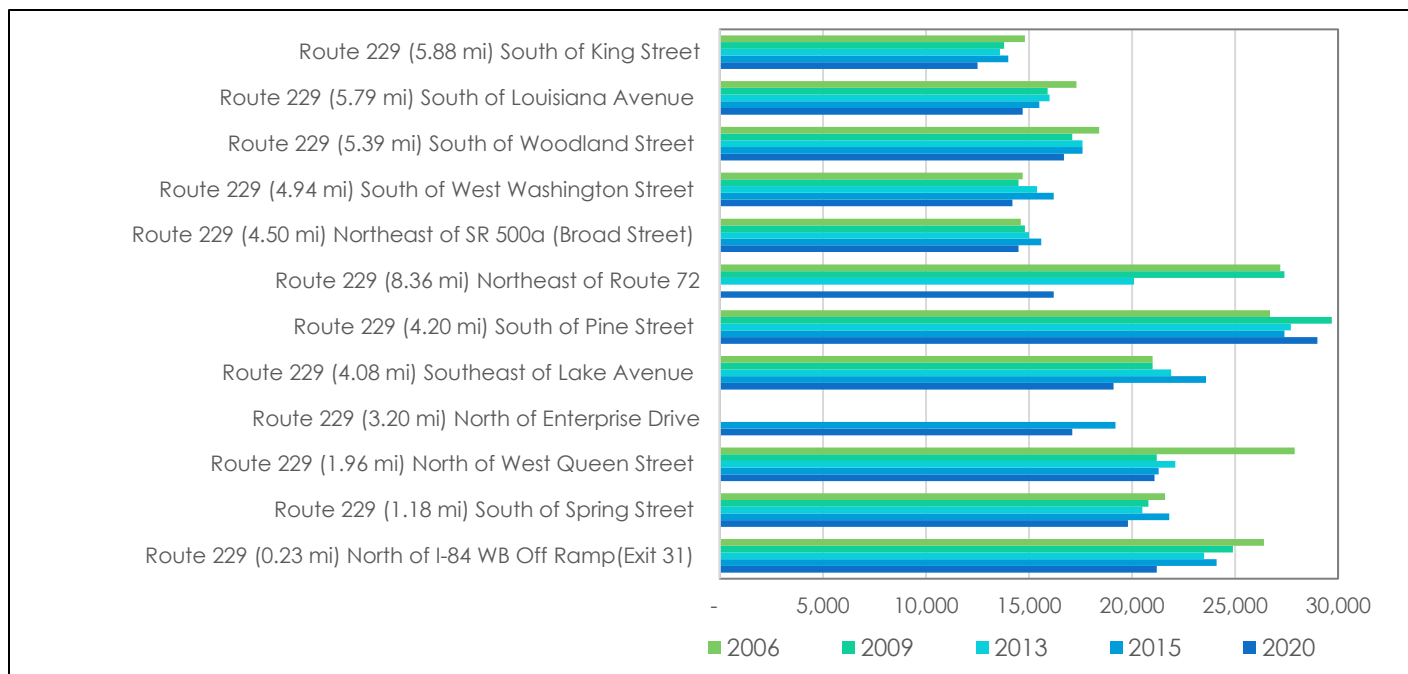


Figure 5 CTDOT Historical Traffic Counts

Table 6: CTDOT Historical Traffic Counts

Location		2020	2015	2013	2009	2006
Southern Segment	CT Route 229 (0.23 mi) North of I-84 WB Off Ramp (Exit 31)	21,200	24,100	23,500	24,900	26,400
	CT Route 229 (1.18 mi) South of Spring Street	19,800	21,800	20,500	20,800	21,600
	CT Route 229 (1.96 mi) North of West Queen Street	21,100	21,300	22,100	21,200	27,900
Central Segment	CT Route 229 (3.20 mi) North of Enterprise Drive	17,100	19,200			
	CT Route 229 (4.08 mi) Southeast of Lake Avenue	19,100	23,600	21,900	21,000	21,000
	CT Route 229 (4.20 mi) South of Pine Street	29,000	27,400	27,700	29,700	26,700
	CT Route 229 (8.36 mi) Northeast of Route 72	16,200		20,100	27,400	27,200
Northern Segment	CT Route 229 (4.50 mi) Northeast of SR 500a (Broad Street)	14,500	15,600	15,000	14,800	14,600
	CT Route 229 (4.94 mi) South of W. Washington Street	14,200	16,200	15,400	14,500	14,700
	CT Route 229 (5.39 mi) South of Woodland Street	16,700	17,600	17,600	17,100	18,400
	CT Route 229 (5.79 mi) South of Louisiana Avenue	14,700	15,500	16,000	15,900	17,300
	CT Route 229 (5.88 mi) South of King Street	12,500	14,000	13,600	13,800	14,800

Historically, the ADT has generally been highest near the intersection with CT Route 72 / Riverside Avenue and Pine Street where volumes ranged from 26,700 to 29,000 vehicles per day (vpd). Note, in 2010, CT Route 72 was rerouted in Bristol onto the new four-lane arterial, a widened Pine Street, and an extended section of Riverside Avenue that crosses the Pequabuck River. This accounts for drop in volumes at the intersection of NE of CT Route 72 between 2009 and 2013.

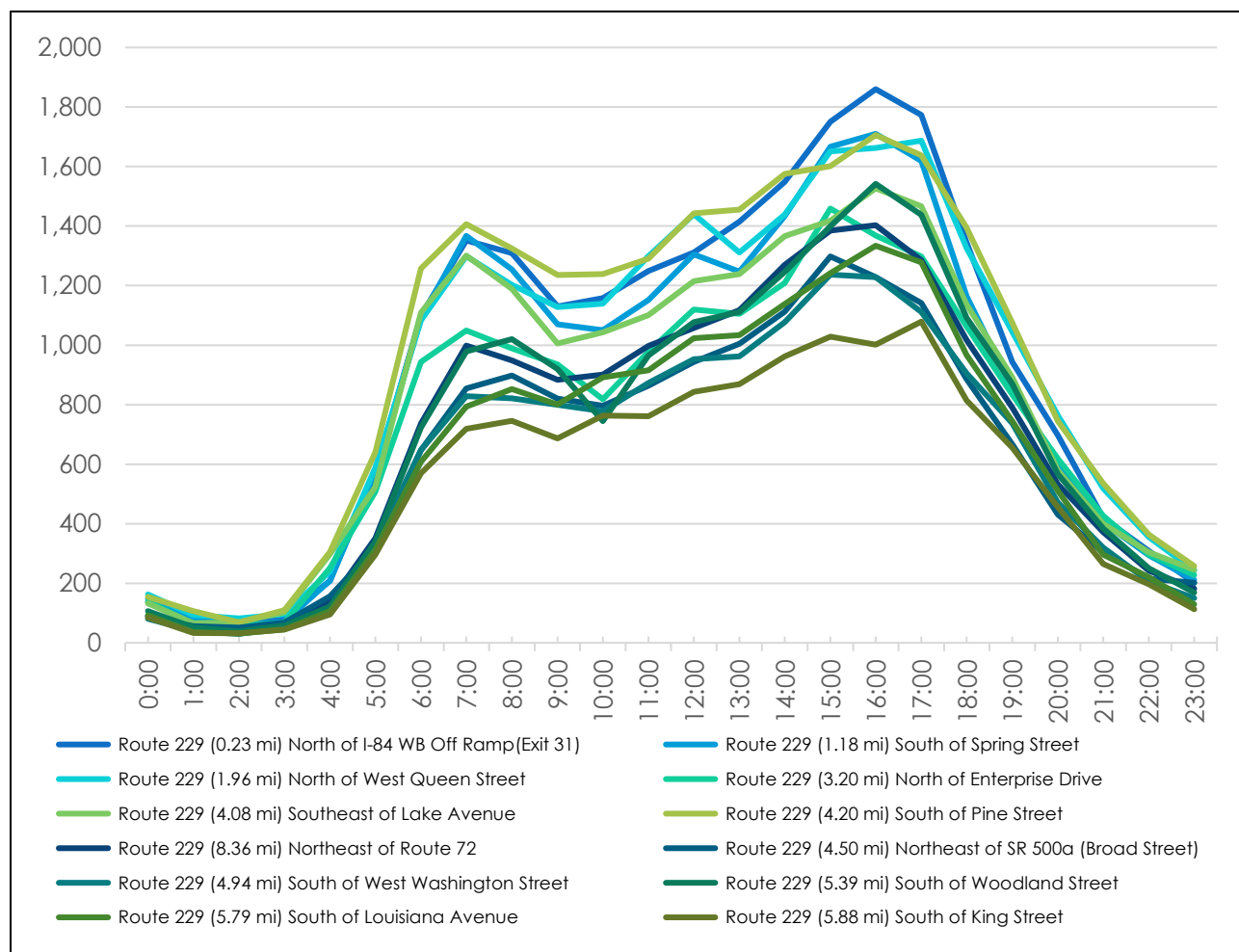


Figure 6 Hourly Traffic Volume Along the Roadway

North of the I-84 Exit 31 ramps, volumes on King Street have ranged from 21,200 to 26,400 vpd. Traffic volumes have been lowest north of SR 500a (Broad Street), ranging from 14,200 to 18,400 vpd. The high volumes in this area demonstrate that CT Route 229 is a major connection for traffic between Bristol, Southington, and I-84 and CT Route 72.

Peak Hour Volumes

In addition to CTDOT historical count data, NVCOG has acquired a subscription to the *StreetLight Data* transportation analytics platform. This platform collects travel information from a wide variety of sources, including GPS data from cell phones and using algorithms estimates traffic volumes and traffic patterns. NVCOG conducted analyses to develop turning movements counts at all key intersections along the corridor. The data have been aggregated to 27-time frame bins which can be summarized as a combination of three weekday descriptions and nine-time frames:

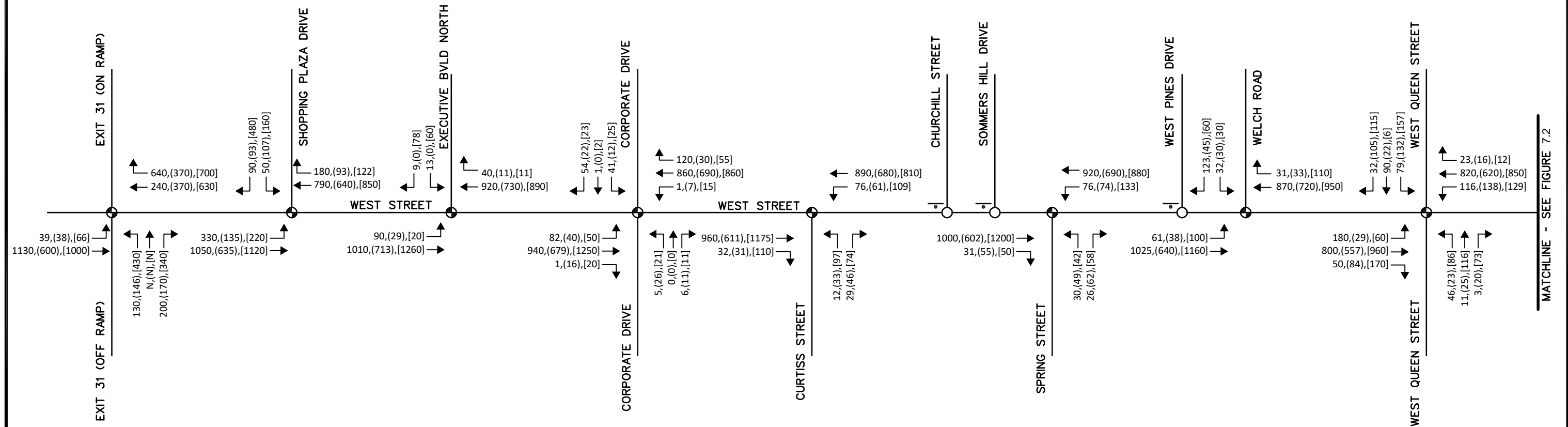
- All days: Monday – Sunday
- Weekdays: Tuesday – Thursday
- Weekend: Saturday – Sunday
- 0: All Day (12am-12am)
- 1: AM (6am-7am)
- 2: AM (7am-8am)
- 3: AM (8am-9am)
- 4: PM (3pm-4pm)
- 5: PM (4pm-5pm)
- 6: PM (5pm-6pm)
- 7: MD 1 (11am-12pm)
- 8: MD 2 (12pm-1pm)

What is Streetlight Data?

In 2016 Streetlight introduced on-demand AADT traffic counts for 4 million miles of U.S. roadway, validated with more than 2,000 permanent counters. Data includes volumes, turning counts, origin-destination patterns, speed / travel data.

Appendix A contains raw counts summarized for average weekday and all hourly daytime frames. The adjusted counts were performed for all signalized intersections for three peak periods: AM, Mid-Day, and PM. Using historical counts collected by CTDOT and comparing these to 2019 numbers based on the Streetlight data, the volumes were balanced, and subsequently reviewed and approved by CTDOT. Although the most recent counts on CT Route 229 were conducted in 2020 by CTDOT, due to the ongoing Coronavirus pandemic, traffic volumes from 2020 onwards were not used directly, only as confirmation of peaking patterns. The balanced peak hour traffic volumes are illustrated on **Figure 7** for the morning and afternoon weekday peak hours, and Saturday midday respectively.

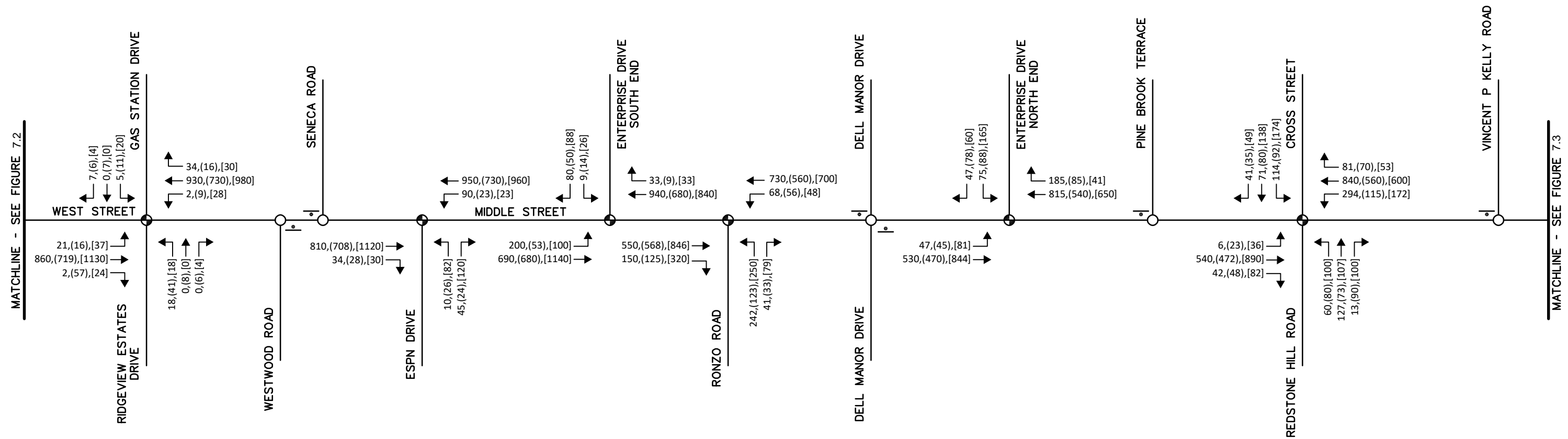
 SIGNALIZED INTERSECTION
 UNSIGNALIZED INTERSECTION
 STOP CONTROL APPROACH
WEEKDAY AM: XXX
WEEKDAY MID-DAY: (XXX)
WEEKDAY PM: [XXX]



MAI CHALINE - SEE FIGURE 7.2

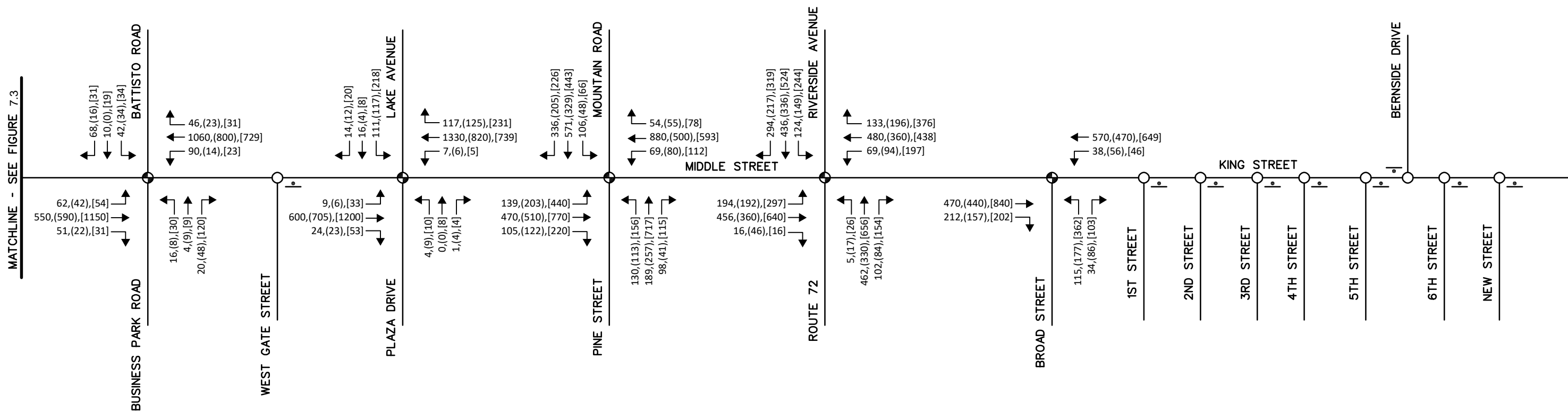
LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- STOP CONTROL APPROACH
- WEEKDAY AM: XXX
- WEEKDAY MID-DAY: (XXX)
- WEEKDAY PM: [XXX]



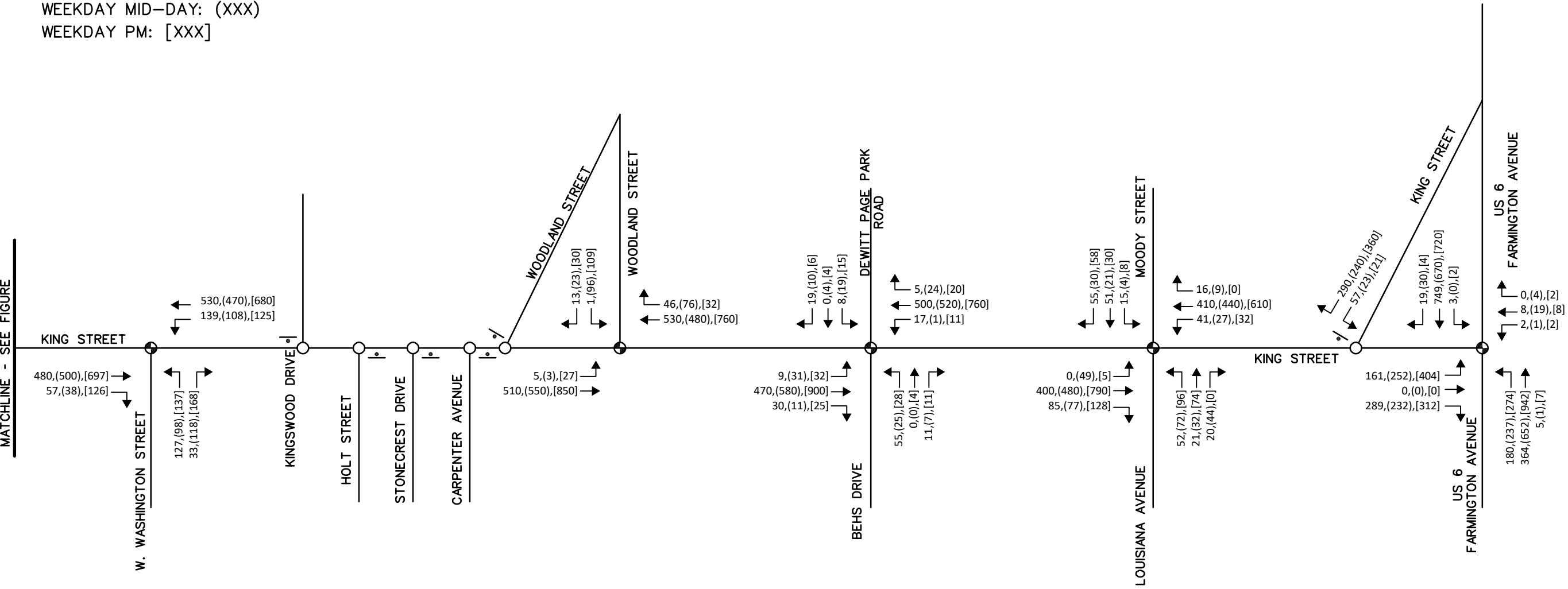
LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- STOP CONTROL APPROACH
- WEEKDAY AM: XXX
- WEEKDAY MID-DAY: (XXX)
- WEEKDAY PM: [XXX]



LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- STOP CONTROL APPROACH
- WEEKDAY AM: XXX
- WEEKDAY MID-DAY: (XXX)
- WEEKDAY PM: [XXX]



ADJUSTED EXISTING (2020) TRAFFIC VOLUMES
CT ROUTE 229 CORRIDOR STUDY
EXISTING CONDITIONS
BRISTOL/SOUTHINGTON, CONNECTICUT
SCHEMATIC, NOT TO SCALE

NOVEMBER 2020

FIGURE 7.4

Speed Limits and Speed Limit Signage

Speed limits and speed limit signs are a critical component of the roadway infrastructure. Speed limits are set at a speed deemed appropriate for the roadway conditions and are established to move traffic in a uniform and safe manner. Signs communicate this critical information to roadway users. In Connecticut, the Office of State Traffic Administration (OSTA), in conjunction with the Local Traffic Authorities (LTA) of the individual towns / cities, establishes speed limits for all public roads. However, if the local community LTA chooses to take on the responsibility and authority to do so, they become the sole authority within the municipal limits per outlined house bill ratified on June 7, 2021.

Public Act No. 21-28: House Bill 5429: Sec. 6. Section 14-218a

(4) (c) (1) The traffic authority of any town, city or borough may establish, modify and maintain speed limits on streets, highways and bridges or in any parking area for ten cars or more or on any private road wholly within the municipality under its jurisdiction without approval from the Office of the State Traffic Administration, provided:

B) The traffic authority notifies the office in writing that the traffic authority is permitted under subparagraph (A) of this subdivision and intends to assume such responsibility and authority

Regulatory speed limits on state and local roads are based on an engineering investigation. Principal factors considered are:

- Road type and surface (curve, hill, etc.)
- Location and type of access points (intersections, entrances, etc.)
- Existing traffic control devices (signs, signals, etc.)
- Accident history
- Traffic volume
- Sight distances
- Test drive results
- Radar speed observations

The 2020 ATR count locations included average and 85th percentile weekday spot speeds. [Table 7](#), below, illustrate the differences between posted speed limit, 85th percentile and average speed. These data points do not include delay from traffic signals, turning vehicles, bus stops, and pedestrian crossings as the data points were selected between major intersections, clear of such influence.

What is 85th Percentile Speed?

The 85th Percentile Speed is the speed that 85 percent of vehicles do not exceed. Another way of looking at this is that only 15 percent of vehicles go faster than this speed, and 85 percent go at or below this speed.

Throughout the Study Area, the posted speed limit ranges between 30 mph and 40 mph as shown in [Figure 8](#). From the intersection with I-84 WB ramps to north of intersection with

Battista Road at Business Park Road, CT Route 229 posted speed limit is 40 mph. The segment formed between the intersection of Battista Road at Business Park Road northerly to Broad Street the posted speed limit is 30 mph and between the intersection of Broad Street traveling northerly to US Route 6 / Farmington Avenue, the posted speed limit is 35 mph.

Table 7: CTDOT ATR Count Location Speed Data (mph)

Location		Mile Post (mi)	Posted Speed Limit (mph)	85% -ile (mph)	Average Speed (mph)	AM Observed Speed (mph)	PM Observed Speed (mph)
Southern Segment	North of I-84 WB Off Ramp (Exit 31)	0.23	40	40	35	32	22
	South of Spring Street	1.18	40	45	40	39	22
	North of West Queen Street	1.96	40	45	35	39	23
Central Segment	North of Enterprise Drive	3.2	40	50	40	36	25
	Southeast of Lake Avenue	4.08	40	50	40	34	25
	South of Pine Street	4.2	30	45	35	33	25
	Northeast of CT Route 72	4.36	30	35	30	33	24
Northern Segment	Northeast of SR 500a (Broad Street)	4.5	35	40	35	33	24
	South of West Washington Street	4.94	35	45	35	33	24
	South of Woodland Street	5.39	35	45	35	33	23
	South of Louisiana Avenue	5.79	35	45	40	32	23



Figure 8 Posted Speed Limit

As shown in [Figure 8](#) and [Table 7](#), the average travel speeds along CT Route 229 are plus or minus five-to-ten mph from the posted speed limits. The average difference between 85th percentile speeds and posted speeds along CT Route 229 is seven miles per hour.

The speed data show that speeding is a safety concern in the CT Route 229 corridor. In the northern and central segment particularly within residential areas where development density and commercial activity are more concentrated and there is an increased potential for conflicts with turning vehicles and pedestrians. It is noted that the character of the existing roadway throughout the corridor can be grouped into two types. The northernmost segment with a posted speed limit of 35 mph reflects a residential character. South of Broad Street to the I-84 ramps, the character of the area is generally commercial / industrial with few unsignalized intersections to residential developments. Posted speed limits of 30 and 40 mph is observed at the southern and central segment respectively. When the character of the roadway does not change, motorists are less inclined to change their speeds upon entering a reduced speed zone, despite the presence of signage for the lower speed limit.

Heavy Vehicles

ATR data collected by the study team in 2020 shows that heavy vehicles, including trucks and buses, comprise 3% to 12% of the daily traffic volumes on CT Route 229, as illustrated in [Table 8](#). The highest percentages of heavy vehicle are south of the CT Route 72 intersection, where 12.6% of vehicles are trucks or buses and north of I-84 WB ramps with 10.3% of heavy vehicles. This is largely due to the major commercial and industrial uses on these stretches of CT Route 229 and proximity to east / west principal arterials. The presence of heavy vehicles is lowest along the northern section of the corridor where the land use is primarily residential.

Table 8: CTDOT ATR Count Location % of Heavy Trucks

Location		2020 ADT	% Heavy Trucks
Southern Segment	CT Route 229 (0.23 mi) North of I-84 WB Off Ramp (Exit 31)	21,200	10.3
	CT Route 229 (1.18 mi) South of Spring Street	19,800	6.9
	CT Route 229 (1.96 mi) North of West Queen Street	21,100	8.9
Central Segment	CT Route 229 (3.20 mi) North of Enterprise Drive	17,100	8.6
	CT Route 229 (4.08 mi) Southeast of Lake Avenue	19,100	10.5
	CT Route 229 (4.20 mi) South of Pine Street	29,000	12.6
	CT Route 229 (4.36 mi) Northeast of CT Route 72	16,200	8.8
Northern Segment	CT Route 229 (4.50 mi) Northeast of SR 500a (Broad Street)	14,500	5.1
	CT Route 229 (4.94 mi) South of West Washington Street	14,200	3.6
	CT Route 229 (5.39 mi) South of Woodland Street	16,700	3.3
	CT Route 229 (5.79 mi) South of Louisiana Avenue	14,700	3.5

Every year, the CTDOT posts vehicle classification reports. Based on 2018 data, other non-interstate principal arterials experience on average 3% to 7% of trucks and buses. **Table 9** provides a sample of site location, comparable AADTs and percentages of heavy vehicles.

Table 9: Sample of Connecticut Non-Interstate Principal Arterial Heavy Vehicle Percentages

Town	Route	Location	Heavy Vehicle Totals (Count)	Heavy Vehicle Percent	Annual Daily Traffic (ADT)
Bethany	69	South of Route 42	949	2.6 %	9,100
Farmington	10	North of Route 4	694	6.5 %	6,600
Farmington	6	Northeast of SR 552	1,977	5.5 %	18,500
New Haven	152	Dixwell Ave, South of Gibbs St.	1,420	6.7 %	10,900
Wethersfield	15	NE of Pawtucket Avenue	12,489	5.7 %	41,800

Existing Traffic Operations

Existing traffic operations were evaluated for the Study Area intersections during the weekday morning and afternoon peak hours. The capacity and queue analyses were conducted using Trafficware's Synchro plus SimTraffic 11 model, a Traffic Signal Coordination Software, based on the 2010 Highway Capacity Manual (HCM) methodology.

Signalized intersections are analyzed in terms of vehicle capacity and motorist delay. Capacity is the maximum rate of vehicle flow through an intersection given typical operating conditions. The number of vehicles traveling through an intersection is divided by the capacity of the intersection to determine an overall volume-to-capacity ratio (v/c). A v/c value under 1.00 indicates that the number of vehicles traveling through an intersection is less than capacity, while a v/c ratio greater than 1.00 is indicative of intersection congestion.

As stated in the HCM, level of service for signalized intersections is defined in terms of control delay. Control delay measures the increase in delay a motorist experiences while encountering a traffic control signal. These factors include initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. This delay is measured per vehicle for a 15-minute analysis period and is associated with the levels of service, which are summarized in **Table 10** below:

Table 10: Signalized Intersection – Level of Service

Level of Service ¹	Average Control Delay (seconds per vehicle)
A	≤ 10
B	> 10 and ≤ 20
C	> 20 and ≤ 35
D	> 35 and ≤ 55
E	> 55 and ≤ 80
F	> 80

¹ If volume-to-capacity ratio is over 1.0 for a lane group, LOS F. Intersection and approach-based LOS is based solely on control delay.

Level of Service A represents the optimum level where most motorists arrive at the subject intersection during the green phase and thus experience virtually no delay. Conversely, Level of Service F indicates that motorists are delayed over 80 seconds while traveling through the intersection and can often imply a complete breakdown of that location. Level of Service D is generally considered the limit of delay acceptable to motorist.

Figure 9 through **Figure 11** presents a visual representation of the overall intersection LOS results on a Study Area map for the three segments respectively with LOS color coded by letter. Table 11 provides a summary for the morning, midday, and afternoon peak hour analysis results for signalized Study Area intersections in terms of LOS and average delay. **Appendix I** provides detail LOS for each movement including v/c ratio and queuing. The capacity analysis reports from the Synchro simulation are included in **Appendix I** for the morning, midday, and afternoon peak hours respectively.

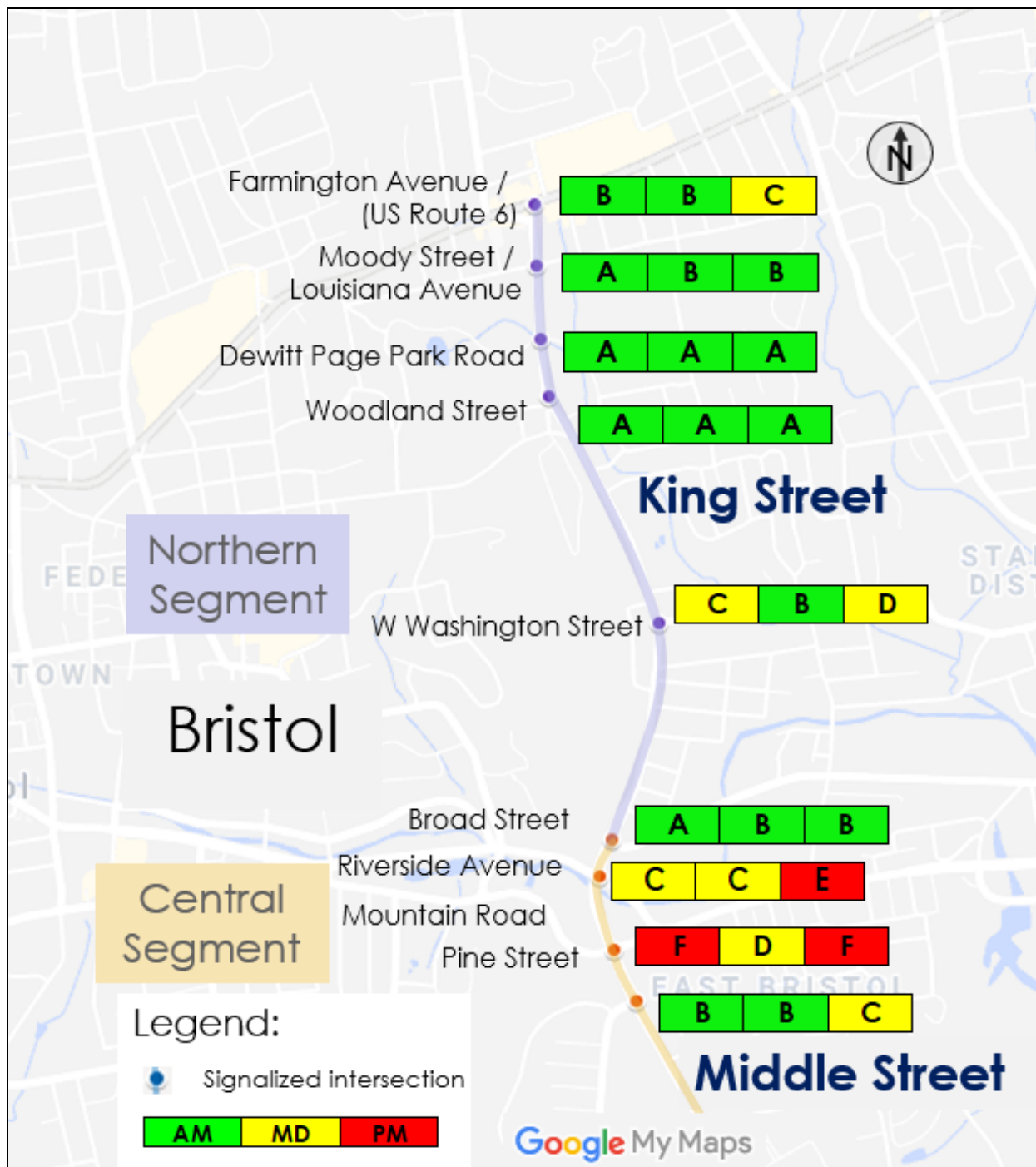


Figure 9 Service (LOS) for Northern Section of Study Intersection

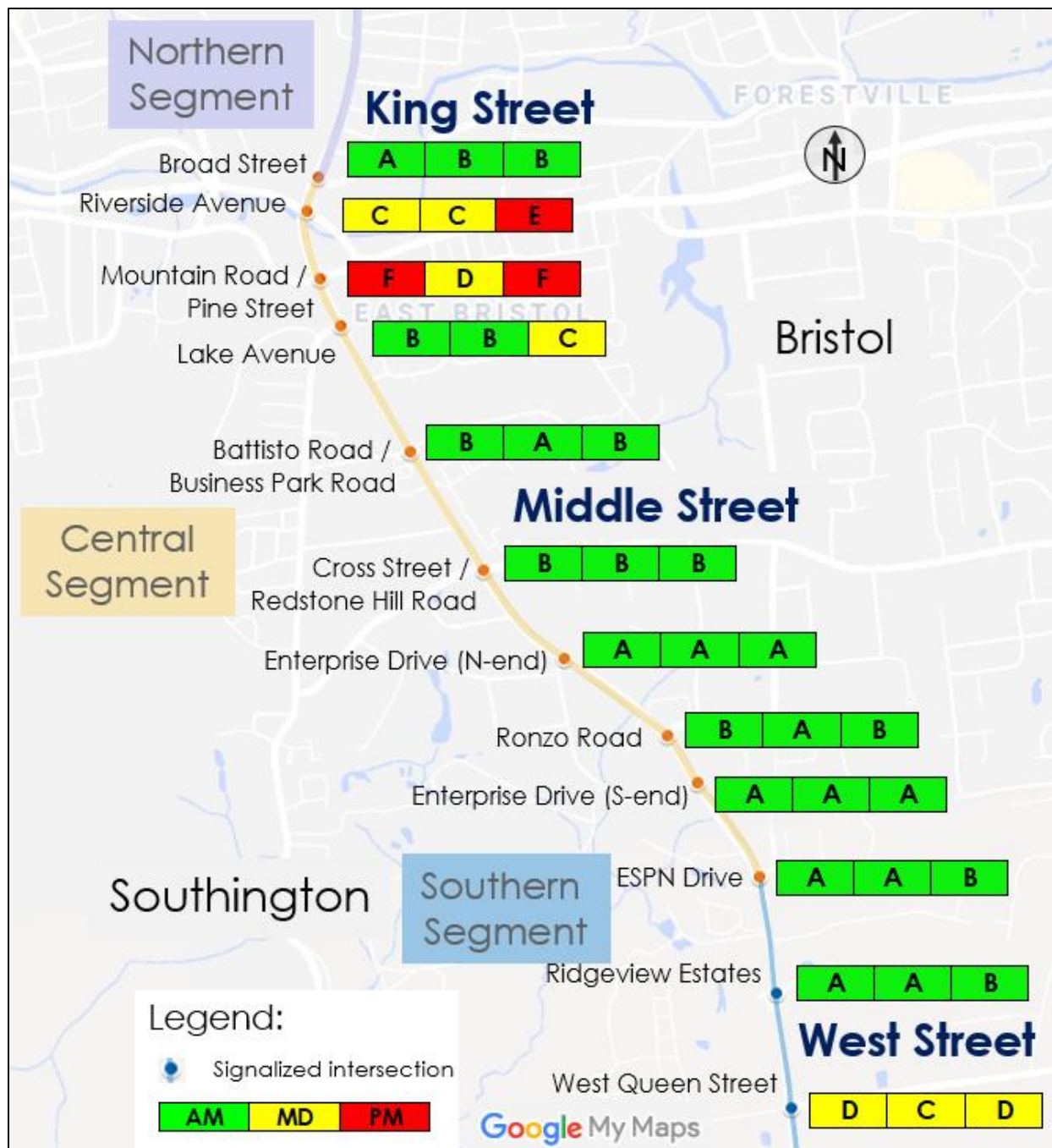


Figure 10 Service (LOS) for Central Section of Study Intersection

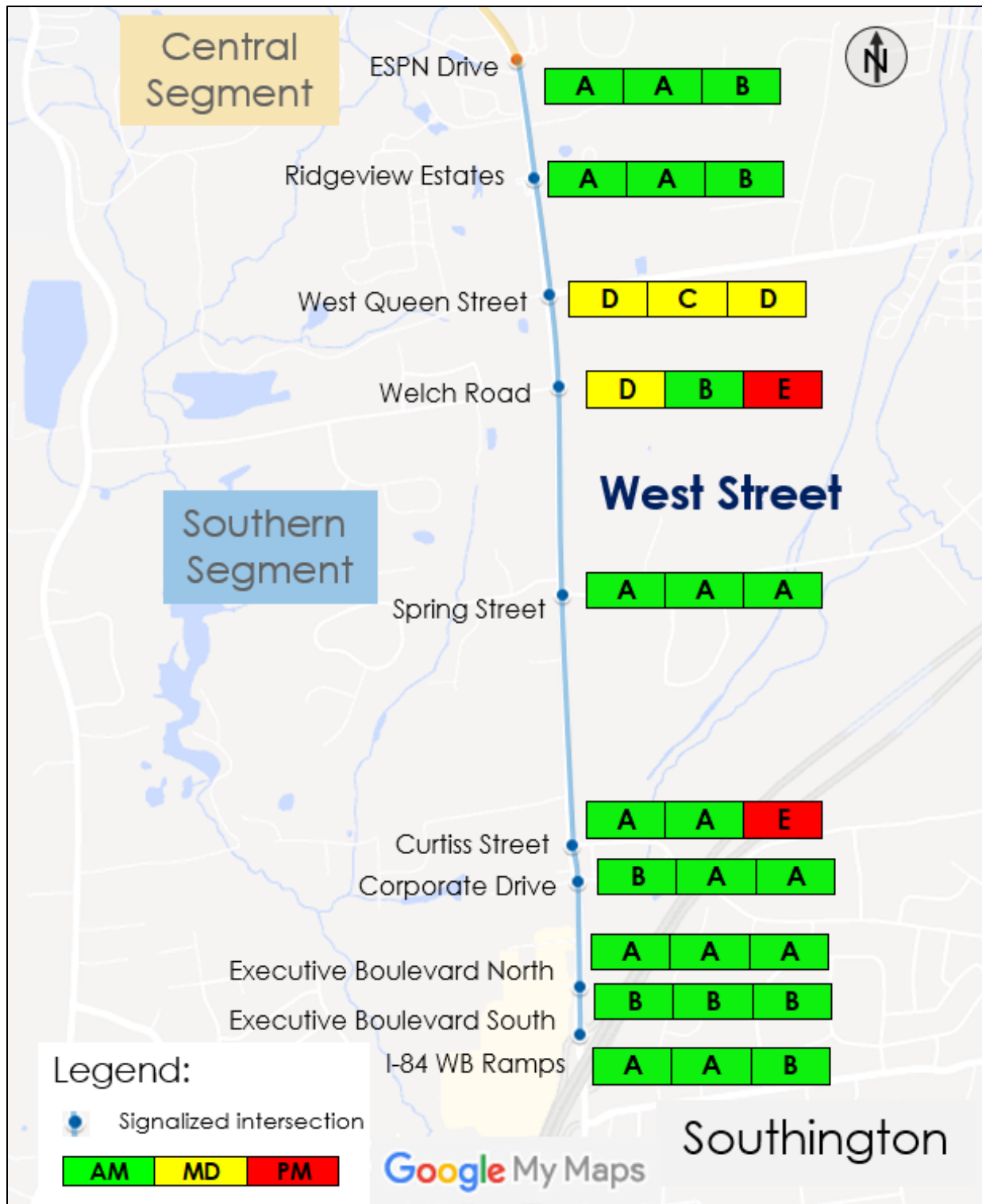


Figure 11 Service (LOS) for Southern Section of Study Intersection

Table 11: Signalized Intersection – Level of Service

	Intersections with RT-229	2020 Existing Conditions Level of Service / Delay (seconds)		
		AM	MD	PM
King Street Northern Segment	at Farmington Avenue / US6	B/12.9	B/17.4	C/22.0
	at Moody Street / Louisiana Avenue	A/9.7	B/12.3	B/18.6
	at Page Park Road / High School	A/4.9	A/4.2	A/6.7
	at Woodland Street	A/1.5	A/6.2	A/8.9
	at West Washington Street	C/24.3	B/19.6	D/38.4
	at Broad Street	A/8.7	B/13.0	B/14.8
Middle Street Central Segment	at Riverside Avenue / Relocated Route 72	C/31.2	C/24.2	E/62.3
	at Mountain Road/ Pine St	F/152.5	D/38.7	F/109.4
	at Lake Avenue / Terry Commons Driveway	B/13.2	B/16.0	C/23.9
	at Battista Road / Business Park Drive	B/16.7	A/9.0	B/12.6
	at Cross Street / Redstone Hill Road	B/10.6	B/10.4	B/19.0
	at Enterprise Drive North	A/4.0	A/4.8	A/7.5
	at Driveway / Ronzo Road	B/12.0	A/7.5	B/13.2
	at Enterprise Drive South	A/5.0	A/3.6	A/3.6
	at ESPN Drive	A/3.6	A/3.3	B/11.3
West Street Southern Segment	at Private Drive/ Ridgeview Estates	A/7.2	A/6.2	B/10.4
	at West Queen Street	D/40.9	C/29.1	D/42.5
	at Welch Road	D/40.3	B/19.5	E/62.5
	at Spring Street	A/7.6	A/8.2	A/8.5
	at Curtiss Street	A/7.8	A/7.0	E/68.8
	at Corporate Drive / Centrion Plaza Drive	B/14.0	A/5.6	A/9.0
	at Executive Boulevard North	A/6.1	A/2.1	A/9.3
	at Executive Boulevard South	B/12.3	B/10.6	B/14.9
	at I-84 WB On Ramp / I-84 WB Off Ramp	A/8.5	A/8.0	B/14.5

Weekday Morning Peak Hour Operations

During the morning peak hour, the Study Area intersections operate at varying levels of service. As observed in the field, long delays and poor level of service are evident at the CT Route 229 at Pine Street Intersection. The queues far exceed the number of vehicles that are being processed through the signal each cycle.

These poor operating conditions are not adequately reflected in the capacity analysis results since vehicles are not able to pass through the intersection.

Additionally, two intersections with West Queen St and Welch Street perform at LOS D: tolerable operations with average delays approaching one minute. The following additional operational issues are exhibited in the analysis:

CT Route 229 at West Washington Street:

- The CT Route 229 Southbound approach operates with LOS F, a delay of almost 100 seconds and a v/c ratio of 1.04, which is considered over capacity under the HCM methodology.

CT Route 229 at Riverside Avenue / Relocated Route 72:

- The Northbound Left Turn Lane operates at LOS E with 56 seconds of delay.

CT Route 229 at Mountain Road / Pine Street:

- The CT Route 229 Southbound Left Turn approach operates with LOS F and a delay of over 400 seconds. Field observations confirm the queue exceeds beyond left turn storage lane and spill into the through lane.

CT Route 229 at Lake Avenue / Terry Commons Driveway:

- The Lake Avenue Eastbound Left Turn approach operates with LOS E. Observations and analysis confirm that queue is fully contained within the left turn lane storage capacity.
- Terry Commons Driveway Westbound Left operates at LOS E with 78 seconds of delay.

CT Route 229 at West Queen Street:

- West Queen Street shared left-through-right lane operates with LOS E and delay of 70 seconds.
- The West Street Southbound shared through-right lane operates with LOS E, a delay of 68 seconds and a v/c ratio of 1.08, which is considered over capacity under the HCM methodology.

CT Route 229 at Welch Road:

- The Southbound Right Turn Lane operates at LOS F with 87 seconds of delay.

Weekday Evening Peak Hour Operations

During the afternoon peak hour, Study Area intersections experience similar delays as the morning peak hour with some intersections operating better and some worse due to the directional shift in commuter traffic departing from the Study Area to the regional roadways. As observed in the field the heaviest volume of traffic is traveling through the intersection of Mountain Road at Pine Street. This intersection experiences extensive queuing along all approaches with gridlock-like operation during the afternoon peak hour.

Additionally, three intersections, at Riverside Avenue, West Queen Street and Welch Street, perform at LOS E with unstable flow at capacity with average delays of one minute. When looking at the individual movement, the following additional operational issues are exhibited in the analysis:

CT Route 229 at US Route 6 (Farmington Avenue):

- CT Route 229 Northbound queues during the pm peak period extends close to the southerly signalized intersection of CT Route 229 and Louisiana Avenue / Moody Street and it affects traffic operation at this downstream intersection.
- Pedestrian amenities should be upgraded

CT Route 229 at West Washington Street:

- CT Route 229 Southbound Left Turn approach operates with LOS F, v/c ratio of 1.35, and a delay of 240 seconds. Field observations confirm the queue exceeds beyond left turn storage lane and spill into through lane.

CT Route 229 at Riverside Avenue / Relocated CT Route 72:

- Both Eastbound and Westbound direction approaches operate with LOS E and V/C ratios just under 1.
- CT Route 229 Northbound Through-Right lane operates with LOS F, with v/c ratio of 1.22, and 150 seconds delay. Field observations confirm long queues and vehicles taking two / three cycles to pass through the intersection.

CT Route 229 at Mountain Road / Pine Street:

- Overall, the intersection operates with LOS F and delay of 109 seconds.
- Both Northbound through-right lane and Southbound left-through approach operate at LOS E and F respectively.

CT Route 229 at Lake Avenue / Terry Commons Driveway:

- The Eastbound and Westbound approaches experience LOS F and E respectively. The delay on Lake Avenue is approximately 90 seconds and at Terry Commons Driveway approach 65-80 seconds.

CT Route 229 at West Queen Street:

- West Queen Street shared left-through-right lane operates with LOS F, v/c ratio of 1.40, and delay of 227 seconds. Observations and analysis confirm long queues and long delay.

CT Route 229 at Welch Road:

- The Southbound Right Turn Lane operates at LOS F with 130 seconds of delay.

CT Route 229 at Curtiss Street:

- The Southbound shared left-through Lane operates at LOS F with v/c ratio of 1.30, and delay of 160 seconds.

Weekday Mid-day Peak Hour Operations

During the midday peak hour, Study Area intersections experience less delay than during AM and PM peak hours as volumes tend to be lower than observed during peak hours. However, some intersection continues to show delays. CT Route 229 Intersecting roads that connect with parallel CT Route 10 / Queen Street experience the most delay. When looking at the individual movements, the following additional operational issues are exhibited in the analysis:

CT Route 229 at West Washington Street:

- The CT Route 229 Southbound Left Turn approach operates with LOS E, v/c ratio of 0.83.

CT Route 229 at Mountain Road / Pine Street:

- The CT Route 229 Southbound Left Turn approach operates with LOS E and a delay of over 57 seconds.

CT Route 229 at Lake Avenue / Terry Commons Driveway:

- The Eastbound and Westbound approaches experience LOS E. The delay on Lake Avenue is approximately 60-75 seconds and at Terry Commons Driveway approach 62 seconds.

CT Route 229 at West Queen Street:

- West Queen Street shared left-through-right lane operates with LOS F, v/c ratio of 1.14, and delay of 127 seconds. Observations and analysis confirm long queues and long delay.

Sources of Delay:

Overall, the sources of delay during AM, Midday and PM peaks are:

- **Irregular signal spacing** – Federal Highway Administration recommends that intersection spacing along an arterial roadway should be regular, with constant distances between traffic signals. A minimum spacing of one-half mile is recommended to regulate traffic flow and preserve capacity along arterial routes, with one-mile spacing considered desirable. When the spacing between signals falls below one-quarter mile (1,320 feet), the traffic flow along the route may be disrupted. The ability of the route to carry through traffic will decrease, travel speeds may decrease, and delays and queues may develop at intersections. It is very difficult to maintain signal coordination when intersection spacing is irregular, as is the case on CT Route 229.
- **School buses** – Multiple school bus routes use CT Route 229 within the Study Area. Some of these buses force traffic in both directions to stop completely and yield to students crossing the road to board the bus. In addition to the school bus routes along CT Route 229, Bristol Eastern High School (BEHS) has school buses dropping off students during the morning peak. As a result of this, the traffic signal at Page Park Road and (BEHS) is not coordinated during part of the morning peak, resulting in additional delay for through traffic. All signals should be coordinated to AM peak period that starts at 6:30AM and ends at 9:30AM. The traffic signal cycle remains in school schedule impacting AM peak travel.
- **Heavy vehicles** – CT Route 229 carries a high percentage of trucks and buses, especially near I-84 Exit 31 ramp and Route 72 intersections. Drivers tend to leave larger front and rear gaps around trucks, thus decreasing the roadway capacity and increasing queue length. Slow acceleration at intersections is a challenge for signal coordination and increases the speed differential, breaking up the groups of vehicles that benefit from coordination.
- **Turning vehicles** – Along the CT Route 229 corridor, vehicles waiting to turn at intersections generally block the through lane. Depending on the shoulder width available, through vehicles may be able to bypass turning vehicles, but they generally slow down when doing so. At some intersections, a left turn lane is provided in lieu of shoulders. This significantly improves through capacity when there are many left turns, though without a shoulder, slowing or stopped right-turning vehicles inhibit the traffic flow. There are 19 unsignalized intersections along the Study Area, including numerous driveways, contributing to delay.
- **Broken detectors** – Vehicle detectors are a critical component of traffic signal design. Detectors activate and extend signal phases, allowing the signal to adapt its timings to meet traffic demand. When a detector malfunctions, the signal operates on an irregular or pre-set cycle and does not correctly respond to traffic demand, causing delays. Broken detectors are a common complaint among stakeholders, and field observations confirm that some phases are being called without vehicles present.

- **Adjacent development patterns** - delays and long queues are a result of the corridor being largely a commuter route servicing the various commercial developments during the peak hours.

Traffic Safety

Motor vehicle collision data for the Study Area were collected from the University of Connecticut (UConn) Crash Data Repository (CTCDR-PR1). The repository was developed in cooperation with the CTDOT Bureau of Policy & Planning, Crash Data & Analysis Unit. The Connecticut system follows national crash data guidelines, referred to as the Model Minimum Uniform Crash Criteria Guideline (MMUCC). In addition, Uniform Fatal Crash Supplement Report (PR-2) is provided for fatal collisions. For the study, the three-year period from January 1, 2017 through December 31, 2019 was used for all crash types and a five-year period was used for fatal crashes. A crash analysis was conducted to help understand how road and intersection conditions affect safety. Because comparing crash data by individual years may distort analysis results, crash totals were calculated for each intersection and segment. In addition to reviewing the number and type of crashes along the CT Route 229 corridor, crash rates were calculated which account for segment length, average daily traffic (ADT), timeframe, and number of crashes. Summaries of the Study Area collisions with select intersections of significant focus or with high collision rates are provided below. The critical analysis factors identified from CTCDR were:

- Number of Crashes
- Crash Type
- Severity
- Crash Location
- Traffic Volume

The crash data collected and generated through this assessment were combined to identify and prioritize high crash locations along the corridor. A total of 949 crashes were recorded in the corridor, 27% of which resulted in injuries.

Crash History

The crash data obtained from the CTCDR revealed that 949 crashes occurred within the Study Area over the three-year period from 2017 through 2019, an annual average of 316 crashes. The crashes were associated with either 24 signalized intersection or 23 segments. In total there were 614 crashes at signalized intersections and 335 crashes on roadway segments. The causes of crashes on CT Route 229 result from a combination of many factors including driver behavior, traffic density, weather and light conditions, and roadway geometry. On average 205 crashes per year were associated with an intersection, while on average 110 crashes per year occurred on roadway segments between intersections. More detail about the types of accidents, severity and crash rates by location provided in follow up section.

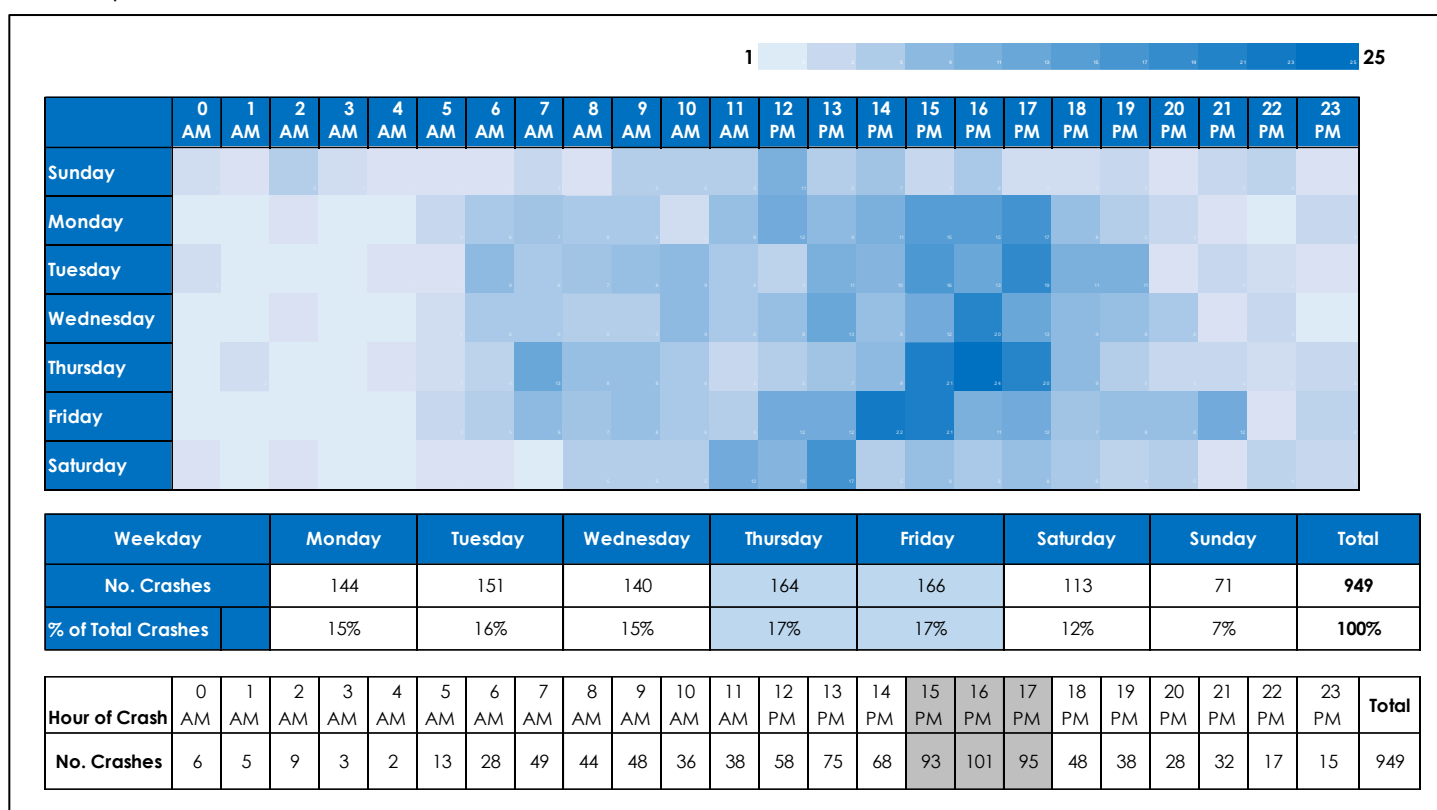


Figure 12 Crashes by day of the week and for 24 hours.

Figure 12 illustrates a slightly higher percentage of crashes occurs on Thursdays and Fridays with 17% of crashes occurring on these two days compared to daily average of 14.2%. Fewer crashes occur on Saturdays and Sundays. Only 7% of the crashes happen on a Sunday and 12% on a Saturday. Similarly, the afternoon hours between 3:00 PM and 5:00 PM have higher percentages of crashes with rates of 10%, 11%, and 10%, respectively. However, in both instances the day of the week or hours should not be considered a contributing factor as during these specific time frames, more vehicles utilize the corridor thus higher chances of crash to occur.

The crash data were broken-down by month. **Figure 13** illustrates the monthly distribution. Slightly more crashes occur in November at 11% with May, July, October, and December experiencing 10% of the crashes in each month. The fewest crashes occur in January through April. However, because of relatively small differences, time of year should not be considered a contributing factor for higher chance of collision to occur.

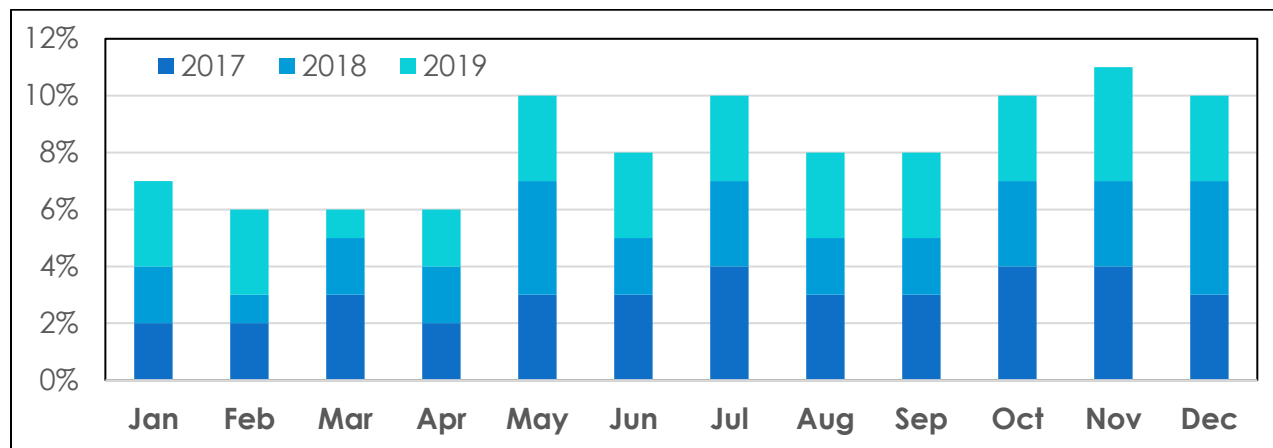


Figure 13 Crashes by month for three years

The most common type of vehicle crash was a front to rear collision. Approximately 45% of all crashes were the result of rear-end collisions. This type of crash is most commonly associated with signalized intersections and is often caused by drivers following too closely. About 31% involved turning vehicles, indicative of a corridor with a lot of driveways and intersections.

Table 12 summarizes the corridor crash type totals for segments and intersections.

Table 12: Summary of Crash Type along the corridor during the 3-year period

Crash Type	Intersection Total	Percent	Segment Total	Percent	Total	Percent
Angle	216	35%	74	22%	290	31%
Front to Front	12	2%	3	1%	15	2%
Front to Rear	263	43%	160	48%	423	45%
Not Applicable	34	6%	35	10%	69	7%
Other	9	1%	8	2%	17	2%
Rear to Rear	2	0%	0	0%	2	0%
Rear to Side	0	0%	1	0%	1	0%
Sideswipe Opposite Direction	5	1%	11	3%	16	2%
Sideswipe Same Direction	73	12%	43	13%	116	12%
Total	614	100%	335	100%	949	100%

Appendix B provides a summary of crash types by individual 24 signalized intersections along the corridor and by 23 segments between the signalized intersections. The data are grouped by the three roadway segments that better reflect roadway and land use cohesion.

Although the number of crashes that occur each year is a concern, the majority (72.6%) only result in property damage only with no apparent injuries. About 25.6% of the crashes resulted in either a possible or suspected minor injury. Crash severity is summarized in **Table 13**. While most of the crashes were not severe, there were four fatal crashes in the corridor during the three-year time period and with an additional two-year look back (total five-year) there were six; averaging one fatal crash per year with 2017 having two. In addition, 13 crashes resulted in a suspected serious injury. These are not just statistics and will be the focus to develop site specific proven strategies to eliminate fatal and serious traffic crashes. More detailed analysis is provided in the following section.

Table 13: Summary of Crash Severity along the corridor during the 3-year period

Severity	Node Total	Percent	Segment Total	Percent	Total	Percent
Fatal Injury (K)	2	0%	2	1%	4	0.4%
Suspected Serious Injury (A)	10	2%	3	1%	13	1.4%
Suspected Minor Injury (B)	75	12%	37	11%	112	11.8%
Possible Injury (C)	96	16%	35	10%	131	13.8%
No Apparent Injury (O)	431	70%	258	77%	689	72.6%
Total	614	100%	335	100%	949	100%

Crash Rates

In addition to reviewing the number and type of crashes along the CT Route 229 corridor, crash rates were calculated. These account for segment length, total number of vehicles entering the intersection (TEV), timeframe, and number of crashes. This approach normalizes the data so that individual segments and intersections can be compared, regardless of their respective length, volume, or crash statistics. For this reason, rates are better suited to reflect safety deficient locations than number of crashes alone. The individual crash rates by intersection are outlined in **Table 14**. The red highlighted value represents the highest crash rate in the corridor, while orange and

Intersection Crash Rate:

Intersection Crash Rate is calculated as follows:

$$Rate = \frac{1,000,000 * No. Crashes}{365 * \frac{Years of Data}{Data} * \frac{Daily Traffic Volume}{Volume}}$$

Road Segment Crash Rate:

Road Segment Crash Rate is calculated as follows:

$$Rate = \frac{1,000,000,000 * No. Crashes}{365 * \frac{Years of Data}{Data} * \frac{Daily Traffic Volume}{Volume} * \frac{Length of Segment}{Segment}}$$

yellow highlights represent significant crash rates, respectively when compared to the corridor average.

Crash rates for intersections are expressed in terms of crashes per million entering vehicles and the rate for road segment represents the number of crashes per mile.

The highest intersection crash rate on CT Route 229 was calculated for the intersection at Pine Street. The crash rate for this intersection was 14.36 crashes per million entering vehicles. The intersections with the highest rates do not necessarily have the highest number of crashes, but rather high concentrations of accidents relative to traffic volume. In the case of Pine Street intersection, it has both the highest number of crashes and highest volume in the corridor. Relatively high crash rates were recorded at Riverside Avenue (5.82), at West Queen Street (4.53) and at Moody Street / Louisiana Avenue (4.16).

In addition to intersection crash rates, road segment crash rates were analyzed. The individual crash rates by segment are outlined in [Table 15](#). This allows to factor in segment length as another factor that normalizes the results for ease of comparison.

Table 14: Summary of Crash Rates by intersection during the 3-year period

	Intersection Location	Total Crashes (3 yrs)	Percent Injury	Million Entering Vehicles (MEV)	Crash Rate
Northern Segment King Street	at Farmington Avenue / US Route 6	21	24%	9.57	2.19
	at Moody Street / Louisiana Avenue	26	35%	6.25	4.16
	at Page Park Road / High School	7	29%	6.09	1.15
	at Woodland Street	7	29%	6.05	1.16
	at West Washington Street	17	6%	6.76	2.51
	at Broad Street	11	18%	9.28	1.18
Central Segment Middle Street	at Riverside Avenue / Relocated CT Route 72	80	33%	13.75	5.82
	at Mountain Road / Pine St	181	28%	12.60	14.36
	at Lake Avenue / Terry Commons Driveway	20	15%	9.31	2.15
	at Battista Road/ Business Park Drive	8	38%	8.90	0.90
	at Cross Street / Redstone Hill Road	23	52%	8.67	2.65
	at Enterprise Drive North	5	60%	7.19	0.69
	at Driveway / Ronzo Road	12	33%	8.26	1.45
	at Enterprise Drive South	10	20%	8.25	1.21
	at ESPN Drive	6	33%	8.40	0.71
Southern Segment West Street	at Ridgeview Estates	4	25%	8.98	0.45
	at West Queen Street	44	32%	9.70	4.53
	at Welch Road	5	60%	8.76	0.57
	at Spring Street	22	36%	8.61	2.56
	at Curtiss Street	28	39%	8.68	3.22
	at Corporate Drive / Centron Plaza Drive	3	33%	8.68	0.35
	at Executive Boulevard North	17	35%	9.19	1.85
	at Executive Boulevard South	23	22%	10.27	2.24
	at I-84 WB On Ramp / I-84 WB Off Ramp	34	21%	9.20	3.70
	Total Intersection Crashes	614	65%		
Note: the CTDOT Data repository (https://ctcrash.uconn.edu/) states that on state non-interstate principal arterials the following accident rates were observed from 2018-2020:					
- 0.3% of all crashes were fatal					
- Approximately 26% of crashes resulted in injury					
- The remaining 74% of crashes were property damage only.					
These percentages are based on 12,452 reported crashes over the last three years. MEV was based total of three hours of one-hour peak periods (AM, PM, and Mid-day) Crash rates were collected for all 24-hours.					

Table 15: Summary of Crash Rates on Route 229 by segments during the 3-year period

Segment of Route 229		Total Crashes (3 yrs)	% Injury	2015 AADT *	Million Entering Vehicles (MVT)	Crash Rate / mile	Most Prevalent Collision Type
Northern Segment King Street	US Route 6 / Farmington Avenue & Moody Street / Louisiana Avenue	33	21%	14,000	1.99	16.56	Angle
	Moody Street / Louisiana Avenue & High School Drive	16	25%	15,500	2.72	5.89	Front to Rear
	High School Drive & Woodland Street	8	38%	17,600	2.51	3.19	Front to Rear
	Woodland Street & W. Washington Street	11	18%	16,200	9.76	1.13	Front to Rear
	W. Washington Street & Broad Street	36	22%	15,600	8.37	4.30	Front to Rear
	Broad Street & CT Route 72	4	0%	16,200	1.42	2.82	Sideswipe
Central Segment Middle Street	Route 72 & Pine Street	27	26%	21,800 *	3.82	7.07	Angle
	Pine Street & Lake Avenue	12	8%	27,400	3.60	3.33	Front to Rear
	Lake Avenue & Business Park Road	21	24%	23,600 *	8.53	2.46	Angle
	Business Park Road & Cross Street	14	14%	21,400	7.73	1.81	Angle
	Cross Street & Enterprise Drive	13	31%	19,200	6.10	2.13	Angle
	Enterprise Drive & Ronzo Road	10	10%	20,250 *	6.65	1.50	Other
	Ronzo Road & Enterprise Drive South	2	0%	20,250 *	2.88	0.69	Other
	Enterprise Drive South & ESPN Drive	5	0%	20,250 *	5.99	0.84	Front to Rear
	ESPN Drive & West Street	22	41%	20,250 *	6.43	3.42	Front to Rear
Southern Segment West Street	West Street & West Queen Street	6	17%	21,300	6.30	0.95	Front to Rear
	West Queen Street & Welch Road	16	19%	21,550 *	5.19	3.08	Front to Rear
	Welch Road & Spring Street	15	27%	21,550 *	11.33	1.32	Front to Rear
	Spring Street & Curtiss Street	29	24%	21,800	14.32	2.02	Front to Rear
	Curtiss Street & Corporate Drive	7	57%	22,950 *	2.01	3.48	Front to Rear
	Corporate Drive & Executive Boulevard North	6	0%	22,950 *	3.52	1.71	Front to Rear
	Executive Boulevard North & Executive Boulevard South	12	33%	22,950 *	2.76	4.34	Front to Rear
	Executive Boulevard South & I-84 WB On / Off Ramps	10	10%	24,100	2.90	3.44	Angle
Total		335	35%				

Note: the CTDOT Data repository (<https://ctcrash.uconn.edu/>) states that on state non-interstate principal arterials the following accident rates were observed from 2018-2020:

- 44% of crashes were rear-end (also known as "front to rear"),
- 2% were head-on crashes,
- 20% were angle crashes (ex. T-bone),
- 13% were sideswipes (both same direction and vehicles traveling in different direction),
- 17% were single vehicle crashes, and
- The remaining 4% were categorized as "other".

These percentages are based on 12,452 reported crashes over the last three years.

MEV was based 2015 available Average Daily Counts (ADT) for segments where such data was not available (*) and average ADT was estimated from segment to the north and south.

In the corridor three segments have a crash rate higher than five:

- Between US Route 6 / Farmington Avenue and Moody Street / Louisiana Avenue: 16.86
- Between Moody Street / Louisiana Avenue and High School Drive: 5.89
- Between CT Route 72 and Pine Street: 7.07

These segments would be considered in a future condition analysis to ensure other factors such as roadway geometry, cross section, and other potential differentiating factors are causing the higher rates. For this reason, crash rates provide a tool for use in prioritizing locations for system improvements. There could be other issues not related to traffic volume that affect crash rate.

The crash rates identified in this analysis were calculated using professionally recognized methodologies; therefore, they may be used in pursuit of Highway Safety Funds through the Federal Highway Administration (FHWA). While the CTDOT does not set thresholds for crash rates, the areas along the CT Route 229 corridor highlighted in red warrant more immediate attention. The CTDOT has established the Highway Safety Improvement Program (HSIP). The HSIP allocates resources to incorporate safety improvements across a broad range of maintenance, safety, and non-infrastructure projects.

Fatal Crashes

There were six (6) fatal crashes along CT Route 229 between 2015 and 2020. Five of these crashes occurred in Bristol and one in Southington. One of the crashes involved a pedestrian while three others involved a motorcycle collision. The remaining two crashes involved automobiles.

While reviewing the data, a common contributing factor could not be selected for the fatal crash. Instead, a multitude of conditions including weather, roadway condition, under the influence of a substance, daylight, wearing protective gear (helmet), etc. were cited as a factor in causing the fatality to occur. [Appendix C](#) provides a detailed summary of each fatal crash.

The CTDOT HSIP program is a Federal-aid program with the purpose of achieving a significant reduction in fatalities and serious injuries on all public roads, such as on Route 229. Under the development of improvements, various strategies will be developed to support NVCOG's Vision Zero goal.

What is Vision Zero?

Vision Zero is a movement founded in Sweden in the 1990s and its values have since been adopted by numerous countries worldwide including by various cities/ regions/ states in the USA. The guiding principle is *"it can never be ethically acceptable that people are killed or seriously injured when moving within the road transport system."*

Bicycle and Pedestrian Crash History

The crash data for the Study Area were reviewed for crashes involving bicyclists and / or pedestrians. The data, summarized in [Table 16](#), revealed there were five collisions involving pedestrians and three collisions with cyclists. One of the pedestrian-involved crashes resulted in fatality, while the other four pedestrian crashed were noted as “Suspected serious injury.” Two out of three cyclist collisions were also classified as “Suspected serious injury” while only one crash marked with “No Apparent Injury.” While the data show a low number of crashes involving either a pedestrian or bicyclist, the severity of these crashes is a concern. When a vehicle crash involves a pedestrian or bicyclist, a serious injury is a likely outcome.

Table 16: Summary of Bicycle and Pedestrian Crashes during the 3-year period

Location (Intersection / Segment)	Bicycle	Pedestrian	All Other Crashes
Intersection: CT Route 229 at CT Route 72	1	1	80
Intersection: CT Route 229 at Pine Street	0	1	181
Segment: W. Washington Street & Broad Street	0	1	36
Segment: Lake Avenue & Business Park Road	0	1	21
Segment: Business Park Road & Cross Street	1	1	14
Segment: Curtiss Street & Corporate Drive	1	0	7
Total	3	5	

In total there were eight pedestrian or bicyclist-related crashes: seven occurred in Bristol and one in Southington. These crashes took place during warmer weather months between May and December. Two of these crashes were recorded in May and one occurred in each month between June through December. Most (five) took place during the evening nighttime from 9:00 PM to 2:00 AM, suggesting that visibility could be a factor. The other three crashes happened during daylight hours from 11:00 AM to 8:00 PM. Based on data queries, no discernable contributing circumstances were identified. In terms of location, three of these crashes took place at two intersections:

- At Pine Street -- 1 crash
- At Route 72 / Riverside Avenue – 2 crashes

Five of these crashes occurred along road segments. These segments are:

- Between Business Park Road and Cross Street -- 2 crashes

- Between Curtiss Street and Corporate Drive -- 1 crash
- Between Lake Avenue and Business Park Road -- 1 crash
- Between West Washington Street and Broad Street -- 1 crash

Please note the identified intersection locations also reflect the highest crash counts and rates for all crashes. In addition, significant segments of the Study Area do not provide facilities for either bicycles or pedestrians. The lack of facilities likely limits the number of pedestrians and bicyclists using the corridor, thereby, tending to keep the number of pedestrian and bicyclist crashes low. Under the development of improvements, the safety of implementing these types of non-motorized facilities will be considered.

Crash Observations

Crash statistics provide a tool for identifying locations with safety concern and prioritizing locations on Route 229 for improvement. The data also provide the basis for a more in-depth discussion of safety issues and opportunities.

- Over a three-year period, 949 crashes were recorded, or approximately six crashes per week somewhere along the corridor. In general, the causes of crashes on Route 229 stem from a combination of many factors including driver behavior, a mix of local and through traffic, weather and light conditions, and roadway geometry – narrow shoulders, poor visibility, dense curb cuts, and lack of dedicated turning lanes at non-signalized intersections.
- In Bristol, CT Route 229 is characterized by high driveway density and at non-signalized intersections. This section of CT Route 229 has a high proportion of turning vehicles in the traffic stream and may contribute to the high percentage of rear-end collisions when compared against corridor averages. Furthermore, posted speed limits on CT Route 229 range from 30 mph between Pine Street and Broad Street and increases to 35 mph between Broad Street and Farmington Avenue, while the roadway character / design does not always reflect change of roadway character.
- Route 229 follows a curvilinear alignment between Lake Avenue and Moody Street / Louisiana Avenue intersections; limited sight distance may be a leading factor in the high concentration of crashes relative to traffic volume near downtown and high activity areas.
- In Bristol, congestion occurs along CT Route 229 near the US Route 6 / Farmington Avenue intersection and at the entrance to Bristol Eastern High School. Crash data in this area has indicated a high percentage of rear-end collisions, likely associated with sight distance challenges and poor roadway geometry.
- At the intersection with Pine Street 55% of crashes are “Sideswipe” which is generally a result of lane changes or improper passing, as a driver may aggressively attempt a last-minute lane change to access an abutting land use or maneuver past a slowing or stopped vehicle.
- Left-turns from cross streets, particularly across 4-lane sections at Pine Street are problematic for drivers on CT Route 229 due to the limited the number of gaps –

space between vehicles, in traffic. This is exacerbated by traffic demand that remains high throughout the day.

- Detail summary of bicycle and pedestrian crashes crash data was developed. In total there were eight crashes: seven in Bristol and one in Southington. Due to the low number of crashes involving pedestrians and bicyclists, it is not possible to identify any pattern of occurrence or primary causes. However, the lack of accommodations for these travelers may be contributing factor that require more detailed assessment. In addition, these crashes tend to occur at locations that have high traffic volumes and are also locations where overall crash rates are high.

Access Management

Access management is the process of balancing the competing needs of traffic movement and land access. Points of access introduce conflict and friction into the traffic stream. Access design characteristics of a roadway that directly impact traffic flow and safety include the location, spacing, and design of access drives entering the roadway as well as the location of signals, medians, and turn lanes. Allowing dense, uncontrolled access spacing results in safety, operational, and aesthetic deficiencies for all users. Access management focuses on safety of travel and minimizing conflict points (locations where vehicles can cross paths) to maintain the smooth flow of traffic along a roadway. Maintaining smooth traffic flow can in turn reduce the need for roadway widening induced by growing congestion.

- According to NCHRP Report 420: Impact of Access Management Techniques, every unsignalized access increases the corridor crash rate by approximately two percent and decreases corridor travel speeds by 0.25 miles per hour.
- The safety and operational issues caused by dense access spacing potentially makes an area less attractive to developers and the general traveling public. Multiple national studies have shown most people are willing to accept a longer trip, including U-turns, to access destination businesses as long as the ride is pleasant and congestion free.

The disadvantages of multiple, uncoordinated, closely spaced access points include:

- Multiple points of conflict and increased potential for collisions
- Disruption to traffic flow and increased congestion
- Conflicts with existing or potential sidewalk network and / or bicycle lanes

There are numerous areas along the CT Route 229 corridor in both Bristol and Southington where there are multiple, closely spaced access points. **Figure 14** shows total number of access points by segment, type, and general location on the roadway.

There are numerous commercial and residential driveways along the corridor, in addition to the controlled and uncontrolled road intersections. As new development and redevelopment is planned along the corridor, it is important to consider the management of access points as part of the site plan approval process. Access management strategies

should be considered in any new development proposal, as well as when a site is redeveloped or a change in use is proposed. Access management includes a wide range of strategies. Common examples include shared driveways, consolidation of driveways, one-way driveways, two-way left-turn lanes (TWLTL), left-turn prohibitions, narrowing access points, and maintenance of sight lines.

This section contains a review of the existing driveways and access management deficiencies. These deficiencies were identified by field visit, stakeholder interviews, a review of crash data, and aerial photos.

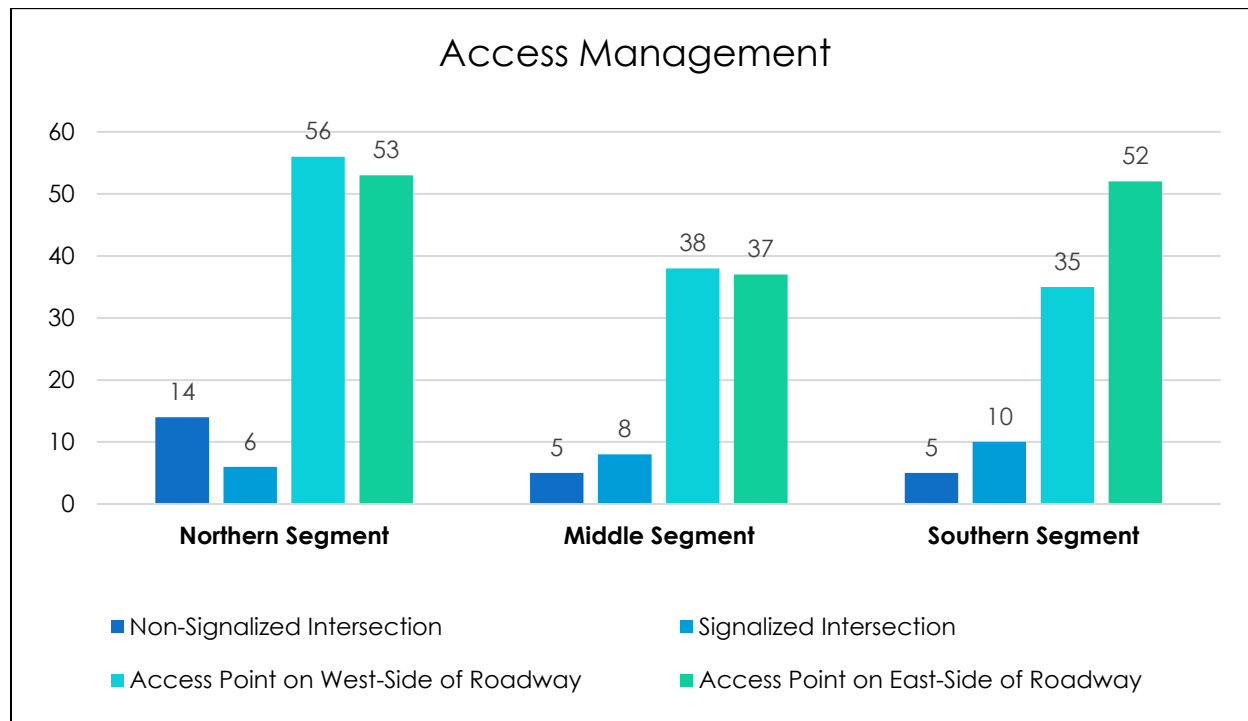


Figure 14 Access Management by Three Segments

In total, there are 319 access points along the corridor, with 48 of these representing intersections. Each segment supports approximately 15-to-20 intersections and 80-to-100 access points to private properties. Many of these access points are clustered in groups. [Figure 14](#) through [Figure 18](#) illustrate the frequency and location of the access / egress points along the corridor. Both Bristol and Southington regulate the construction of new driveways and access points through provisions of their respective zoning regulations. Excerpts of this regulatory language is provided below:

BRISTOL:

“SECTION 602:

9. There shall be no more than two access driveways from the road. The maximum width of each driveway shall be forty feet.

10. A suitably landscaped area shall be maintained at least five feet in depth along all road frontage not used as driveway.

SECTION 720: ACCESS APPROVAL

Driveway approval shall be carried out in accordance with 19 V.S.A. SECTION 1111. However, any activity for which a zoning permit is required and which involves the construction or modification of a driveway intersection with a public right of way shall require, as part of the zoning permit, approval of such construction or modification from the Select board. In order to ensure safety, provide access by emergency vehicles, to minimize traffic difficulties, and to mitigate and / or anticipate drainage problems, the following standards shall apply:"

SOUTHINGTON:

"SECTION 4-00.6

Access to Premises - Access to the premises shall be from existing public streets which abut the premises or from streets which have been developed in accordance with the Subdivision Regulations to serve the business area, and no ingress or egress through residentially zoned land shall be used. Shared driveways are the preferred option where opportunities exist and the Commission will ask the developer to identify any opportunities to do same.

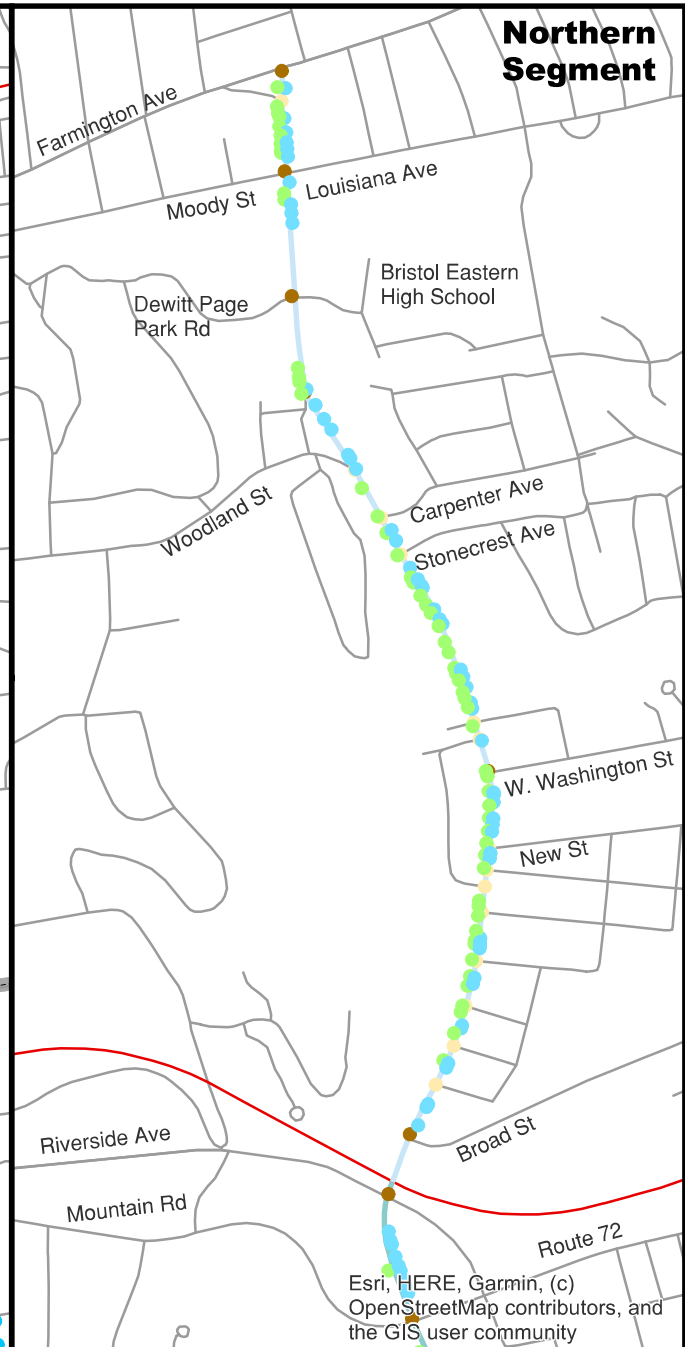
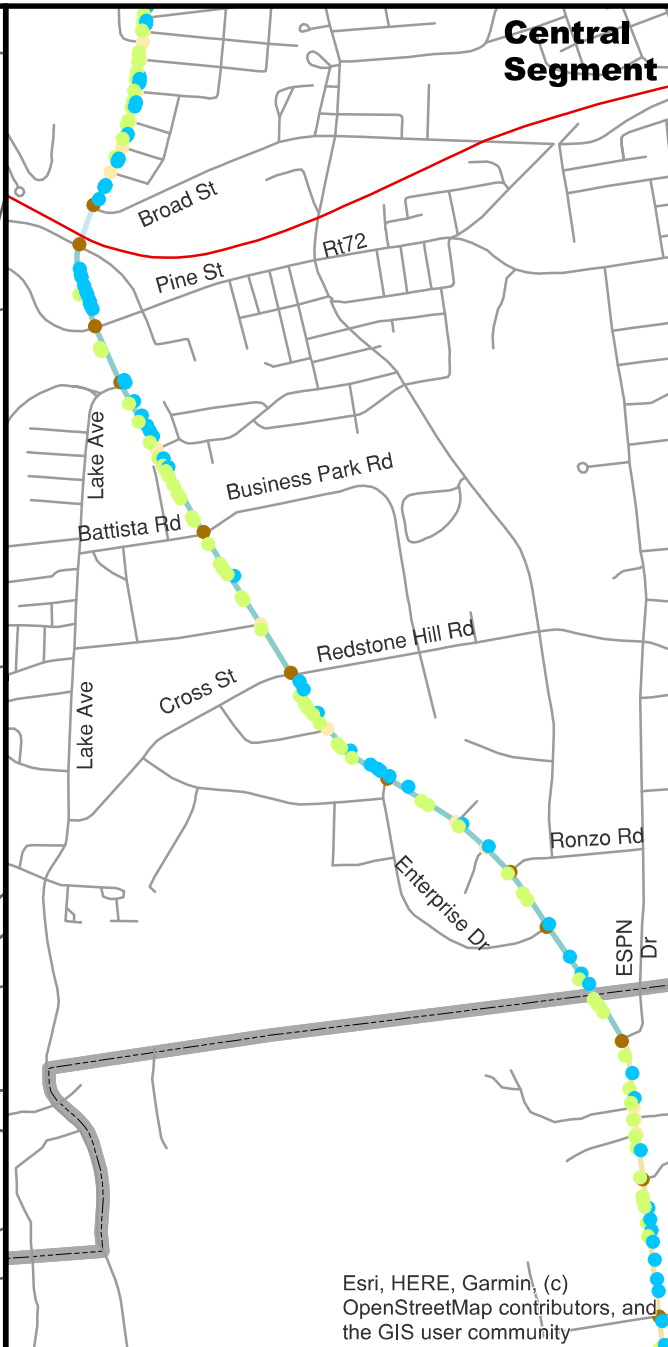
SECTION 4-05.1 West Street Business Zone (WSB)

C. Access Management will be required on all sites to reduce the number of driveway cuts onto West Street, thereby limiting traffic congestion that typically follows increases in commercial activity. Access management techniques will include shared driveways, interior service drives, and cross easements for adjacent parcels."

The recommended access management guidelines for this corridor should follow CTDOT access spacing guidelines. The study corridor is classified as a principal arterial that is intended to provide the mobility of a larger network, with lower category roadways feeding into them. Access guidance for this urban / urbanizing corridor permits primary access spacing every one-half mile and secondary intersections every one-quarter mile. Signalized intersections are permitted every one-quarter mile. Driveway accesses are allowed with spacings between 300-660 feet in the urbanizing portion of the corridor.

Each segment of the CT Route 229 corridor has access points greater than the recommended spacings. Many of the accesses are commercial driveways that are not aligned with an access across from it and only serve a single business. This provides an increase in conflicts between turning traffic to and from these accesses and presents a safety risk along the corridor. A detailed map of the existing access along the corridor can be seen in [Figure 15](#) through [Figure 18](#).

Businesses with redundant driveway access or opportunities to consolidate access on CT Route 229 can better be managed by providing access on a side street instead of CT Route 229 if they do not have it already. Improvements to both access and signal spacing will be considered as part of the alternative analyses.



Legend

AccessPoints

- Non-Signalized
- Signalized
- WestSide
- EastSide

Corridor 3 Segments

- Northern Segment
- Central Segment
- Southern Segment



Town Boundary

CT Roads

CT Rail

N

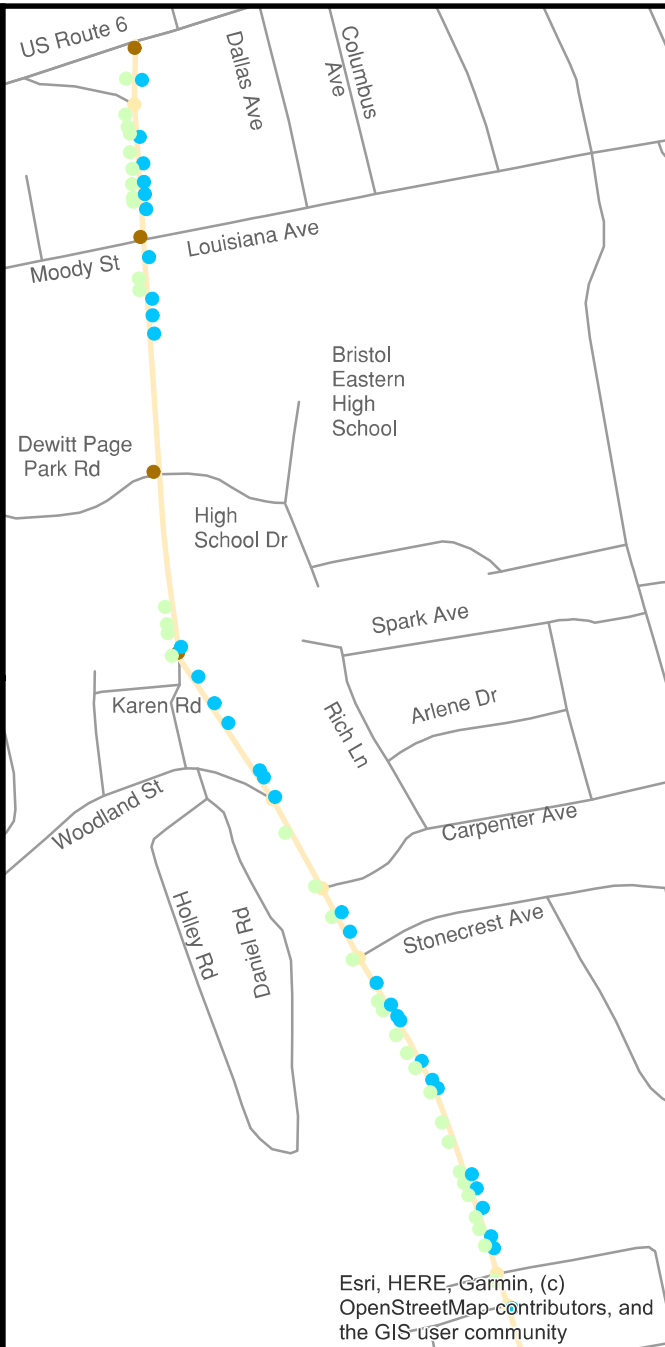
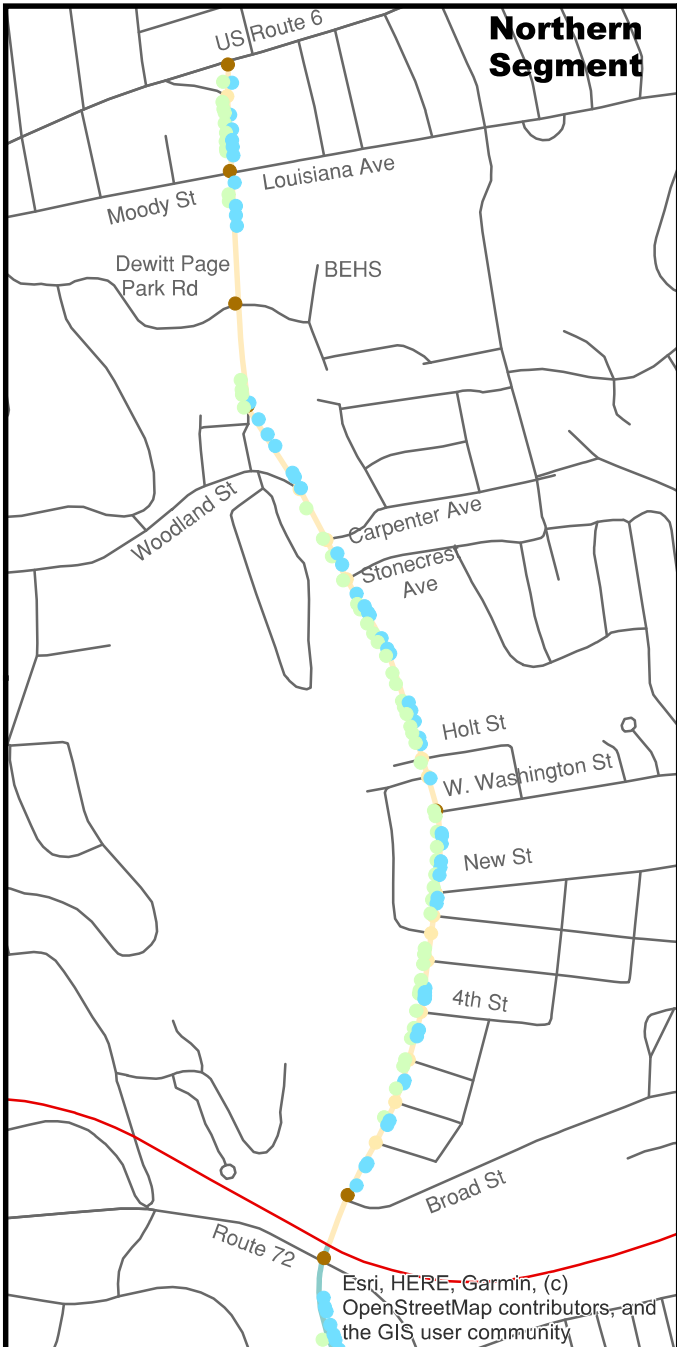


**CT Route 229
Corridor Study**



Architecture
Engineering
Environmental
Land Surveying
Companies

Access Management ALL Segment



Legend

AccessPoints

- Non-Signalized
- Signalized
- WestSide
- EastSide

Corridor 3 Segments

- Northern Segment
- Central Segment
- Southern Segment

- Town Boundary
- CT Roads
- CT Rail

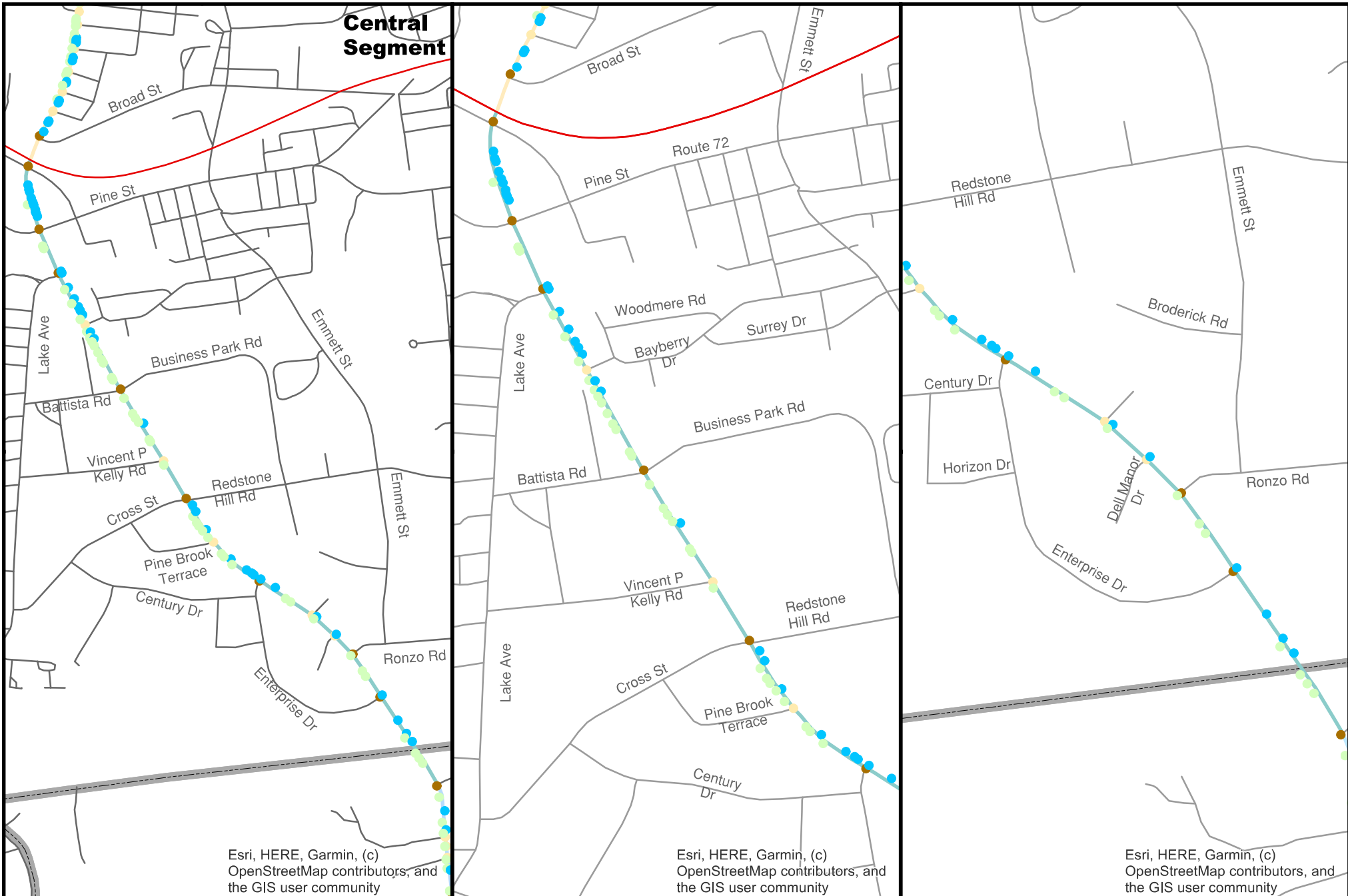
N

Figure 16

CT Route 229 Corridor Study

Architecture
Engineering
Environmental
Land Surveying
Companies

Access Management Northern Segment



Legend

AccessPoints

- Non-Signalized
- Signalized
- WestSide
- EastSide

Corridor 3 Segments

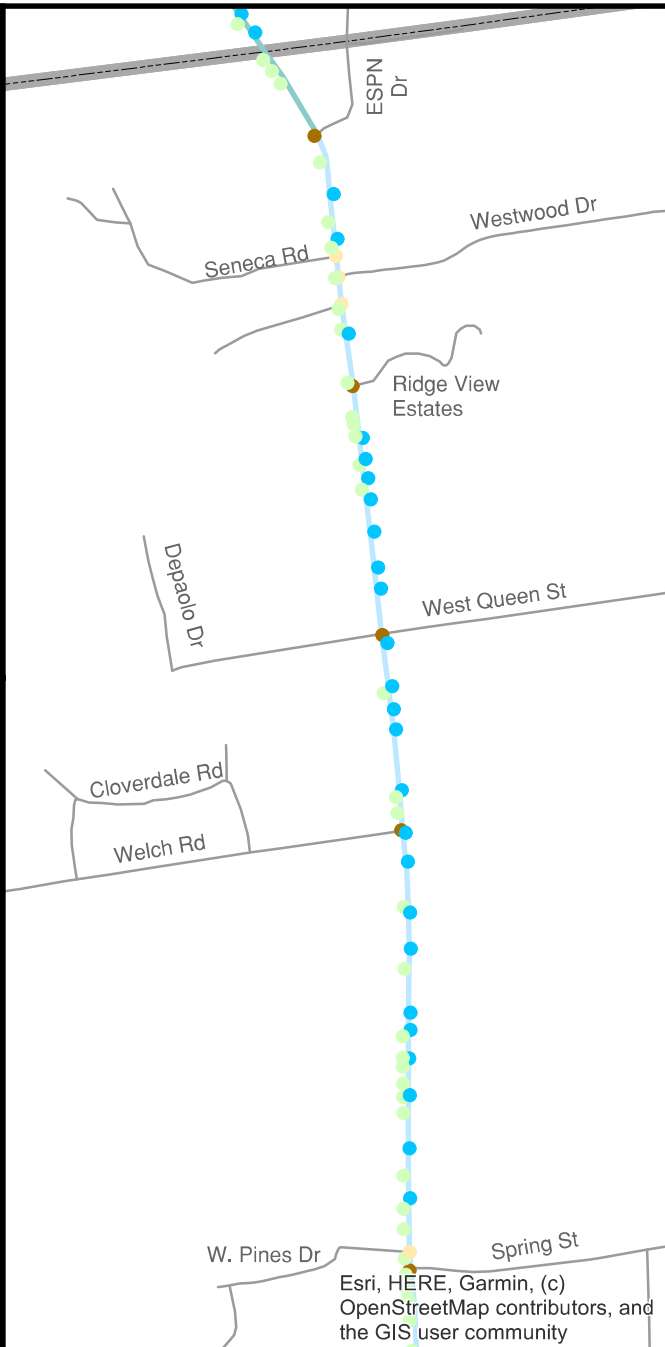
- Northern Segment
- Central Segment
- Southern Segment

- Town Boundary
- CT Roads
- CT Rail

Figure 17

CT Route 229 Corridor Study

Access Management Central Segment



Legend

AccessPoints

- Non-Signalized
- Signalized
- WestSide
- EastSide

Corridor 3 Segments

- Northern Segment
- Central Segment
- Southern Segment



Town Boundary

CT Roads

CT Rail

N



Figure 18

**CT Route 229
Corridor Study**



Architecture
Engineering
Environmental
Land Surveying
Companies

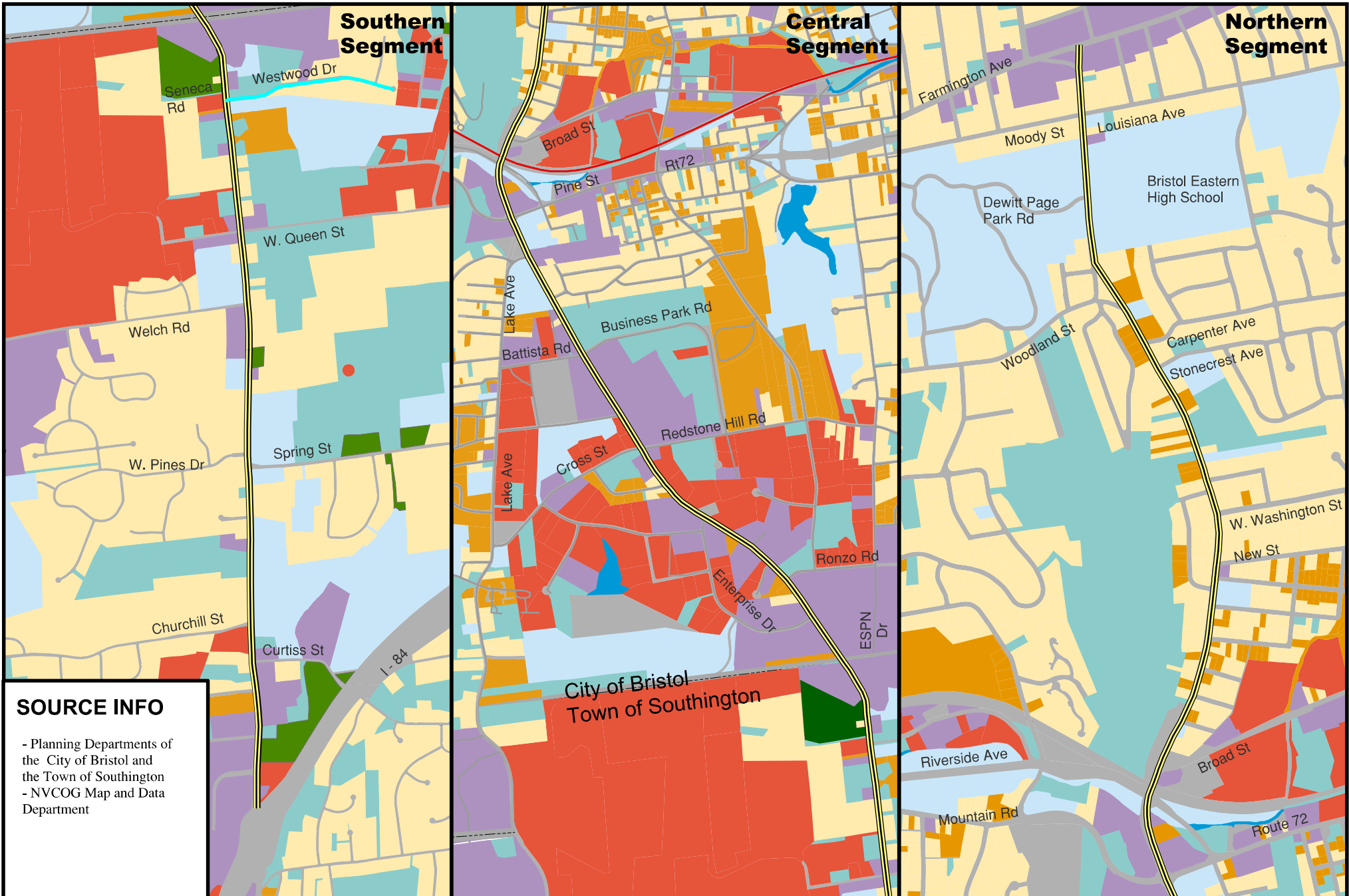
Access Management Southern Segment

Land Use and Zoning

Transportation studies take into consideration the critical link between land use and how it related directly to transportation demand. the critical link between land use and transportation. By promoting coordinated transportation and land use strategies, it is possible to help mitigate traffic growth and preserve capacity by reducing vehicular traffic, improve mobility for bicyclists and pedestrians and generate need for transit facilities.

Zoning and other land use regulations can directly impact regional transportation systems and facilities. Intensively developed land uses, such as commercial and industrial developments in and around the Study Area, generate vehicular traffic that can lead to traffic congestion and costly, potentially expansive roadway capacity improvements. It is therefore important to understand what development potential exists under current zoning regulations and how build-out of various land uses could impact traffic on CT Route 229.

The City of Bristol and the Town of Southington each have a distinct zoning districts zoning districts laid out to meet their local long-term development objectives. Consequently, along CT Route 229 where the municipal boundaries meet, the zoning designations from one community are inconsistent with those in the adjacent community. In order to show this effect, zoning by primary intended land uses was generalized and is shown in [Figure 19](#). The three primary zone categories recognized are Residential, Industrial and Business. Other land uses present in the corridor include agriculture, community facilities, transportation right-of-way (ROW), and water. Sites for potential development were also identified with aqua color. These parcels are of particular importance as they drive the connection between established zoning, market conditions, and potential change and improvement of land use. Any new developments that qualify as major traffic generators will potentially have significant impacts on the transportation network.



SOURCE INFO

- Planning Departments of the City of Bristol and the Town of Southington
- NVCOG Map and Data Department

Legend		
Land Use / Zoning	Industrial	Town Boundary
Agriculture	Residential Multi-family	CTRail_Clipped
Business	Residential Single-family	CT Roads
Community Facility	Transpo_ROW	Corridor
Undeveloped		

N

Figure 19

CT ROUTE 229 CORRIDOR STUDY
BRISTOL / SOUTHTON

Land Use and Zoning

Architecture
Engineering
Environmental
Land Surveying

Northern Segment: King Street

The northern segment primary land use is single-family residential with some multi-family areas. Industrial and business uses are located at the north and south edges of the segment along crossing roads of US Route 6 / Farmington Avenue and Broad Street. In the northern limits of the segment, there are community facilities which include Bristol Eastern High School, Page Park, and Wilson Park south of 6th Street. Sheriden Woods Health Care Center property is also delineated as a community facility with potential development parcel directly behind this facility. This parcel could serve as an expansion purposes of the facilities or additional residential developments. The presence of ponds and brooks should be noted as the area serves as a retainage area for Page Park during storm events. The large land mass to the west of the corridor is referred to as Hurley Hill and is a potential development site. Based on zoning of surrounding parcels, the land could be utilized for residential development that could either connect via CT Route 229 or Brewster Road.

Central Segment: Middle Street

Along the central segment, the primary land use is industrial and business with some residential in proximity to Casey Field. The central segment is the economic engine for the City of Bristol with established developments such as ESPN Campus, Executive Blvd Business Park, and retail businesses around the Pine Street area. According to Bristol's 2019 Comprehensive Annual Financial Report, five of ten top employers are located near the CT Route 229 corridor. These include ESPN, Amazon, Sheriden Woods Health Care Center, IDEX Health and Science, and Quality Coils. Other developments include CVS, ALDI, Otis Elevator Test Tower, Village Cabinets, HRF Fasteners Systems, North American Spring Tools, Tollman Spring, Double Tree by Hilton Hotel, CubeSmart Self Storage, Life Storage, Pro Cut of CT, Quality Wire Edm, Lab Security System Corporation, Clean Harbors Environmental, Camp Canine, Radcliff Wire, and many more.

Southern Segment: West Street

The southern segment of the corridor consists of mix-use: residential, commercial, and industrial. Commercial and retail-oriented developments are mostly on the southern edge near I-84. Residential land uses are alongside roads including Welch Road, Churchill Street and West Pines Drive on the west side of the corridor. On the east side Spring Street, Westwood Drive, and West Queen Street. Industrial land use is mostly observed off the corridor on side roads. West Queen Street on the east side provides access to an industrial park on Depaolo Drive and on the east side Captain Lewis Drive. Engineered Construction, as an outlier, is accessed via West Street and located just south of Churchill Street. The southern segment has large parcels of land that are undeveloped or have been classified as community facility. These parcels based on economic and real estate market analysis will be reviewed for potential development under future analysis. The northern edge of this segment is also where the town boundary is located, thus land use and zoning changes. The ESPN campus spans across both communities to the east side of the corridor and leads into business industrial portion of the corridor.

Plan of Conservation and Development (POCD)

Both communities have adopted their individual Plan of Conservation and Development (POCD). This is a tool to guide the community's future development. Its purpose is to establish a common community vision and identify strategies to attain that vision.

The Town of Southington adopted its 2015 POCD plan in 2016 while the City of Bristol adopted its revised plan in 2018.

The Town of Southington has included West Street in the POCD plan, where “West Street Business Areas along West Street where business development will be balanced with residential and other uses.” Also, as part of the “Downtown Enhancement” strategies is to “Promote the appropriate development and redevelopment of West Street and Implement the recommendations of the West Street Steering Committee.”

The Bristol POCD recognizes the CT Route 229 corridor as one of the key routes for regional travel, which primarily serve traffic movements between Bristol and surrounding communities as well as circulation within Bristol. Through the extension of CT Route 72 further to the west into Bristol, the POCD recognizes the opportunities to enhance the overall form and function of this area including CT Route 229.

Environmental and Natural Resources

In addition to reviewing aerial images of the Study Area, current Geographic Information Systems (GIS) data from the Connecticut Department of Energy and Environmental Protection (CT DEEP), NVCOG, CRCOG, and the Towns of Southington and City of Bristol were obtained and reviewed during this screening analysis. The Study Area was screened for the following natural resources and physical environment features:

- Surface Water Resources
- Ground Water Resources
- Wetlands and Floodplains
- Threatened and Endangered Species and Habitats

These resources are generally considered constraints that could affect the feasibility of various improvement alternatives in the corridor. Potential impacts to these resources will be avoided where possible. More specific environmental evaluations and documentation will be completed in accordance with CEPA and NEPA requirements under subsequent initiatives as study recommendations are advanced to design and implementation.

Surface Water Resources

Surface water resources within the Study Area include the Eightmile River, the Pequabuck River and various ponds and lakes associated with the Pequabuck River. The Study Area rests within these two watersheds with the approximate boundary line near the intersection of CT Route 229 at Cross Street / Redstone Street. Both watersheds drain into Farmington River watershed.

Based on the Connecticut Integrated Water Quality Report to Congress from 2019, the water quality in the Pequabuck River (CT 4315) and segments are “not supporting” for recreational uses due to indicator bacteria and also “not supporting” for aquatic life, primarily due to unknown causes from a variety of potential sources. Consequently, this waterbody had been placed on Connecticut’s Impaired Waters List.

The Eightmile River has been identified as Wild Trout Management Area - Class 1, where “catch and release only” is practiced throughout the year and only use of a single-hook artificial lures or flies is permitted.

Ground Water Resources

Most of the groundwater in the Study Area is classified by CTDEEP as Class GB. Class GB designated uses are industrial process water and cooling waters and baseflow for hydraulically-connected water bodies and is presumed not suitable for human consumption without treatment. All groundwaters not specifically classified are considered Class GB. It should be noted the watershed is heavily developed with elevated impervious areas, particularly, along the main stem through the City of Bristol and Town of Plainville. These conditions lead to impaired water quality and altered river function through the alteration of the hydrologic cycle and elevated non-point source (NPS) loading of bacteria, nutrients, and sediments to the river as well as ground water.

Wetlands and Floodplains

Based on a review of CTDEEP GIS mapping shown in [Figure 20](#), poorly drained and very poorly drained soils are located throughout the Study Area. Additionally, alluvial and floodplain soils are located within the Study Area. These areas indicate potential for the presence of wetlands, but do not represent delineated wetland areas.

Floodplains and floodways are important for storing floodwaters so that adjacent properties and downstream areas are not damaged during flood events. During a 100-year flood storm, floodplain is an area that has a one percent chance of being inundated by floodwaters in a given year whereas a 500-year floodplain is an area that has a one-five hundredth chance

(0.2%) of being inundated by floodwaters in a given year. There are 100-year floodplains and 500-year floodplains within the Study Area as shown in [Figure 20](#) through [Figure 22](#). They are primarily associated with the Pequabuck River and Eightmile River. A Regulatory Floodway and Special Floodway area has been identified at the decommissioned Bristol Brass Dam located at the southwest corner of the junction of CT Route 72 and CT Route 229, just upstream of the Middle Street Bridge in Bristol. This means that the channel of a river and the adjacent land areas are reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

Wetland Definition (Federal vs. State)

The **Federal Clean Water Act** definition for wetlands is based on three observations: soil characteristics, hydrophytic vegetation, and hydrology. **Connecticut's** definition of inland wetlands is based on soil characteristics.

What are Floodplains and Floodways?

Floodplains are low-lying areas adjacent to rivers or streams that are inundated periodically by floodwaters.




Floodways consist of the river or stream channel plus any portion of the 100-year floodplain which carries stream flows during flood events.

Legend

 Natural Diversity Database







Soil Survey Data

CT Wetland Soil Type

-  Alluvial and Floodplain Soils
-  Poorly Drained and Very Poorly Drained Soils
-  CT Rail








Corridor 3 Segments

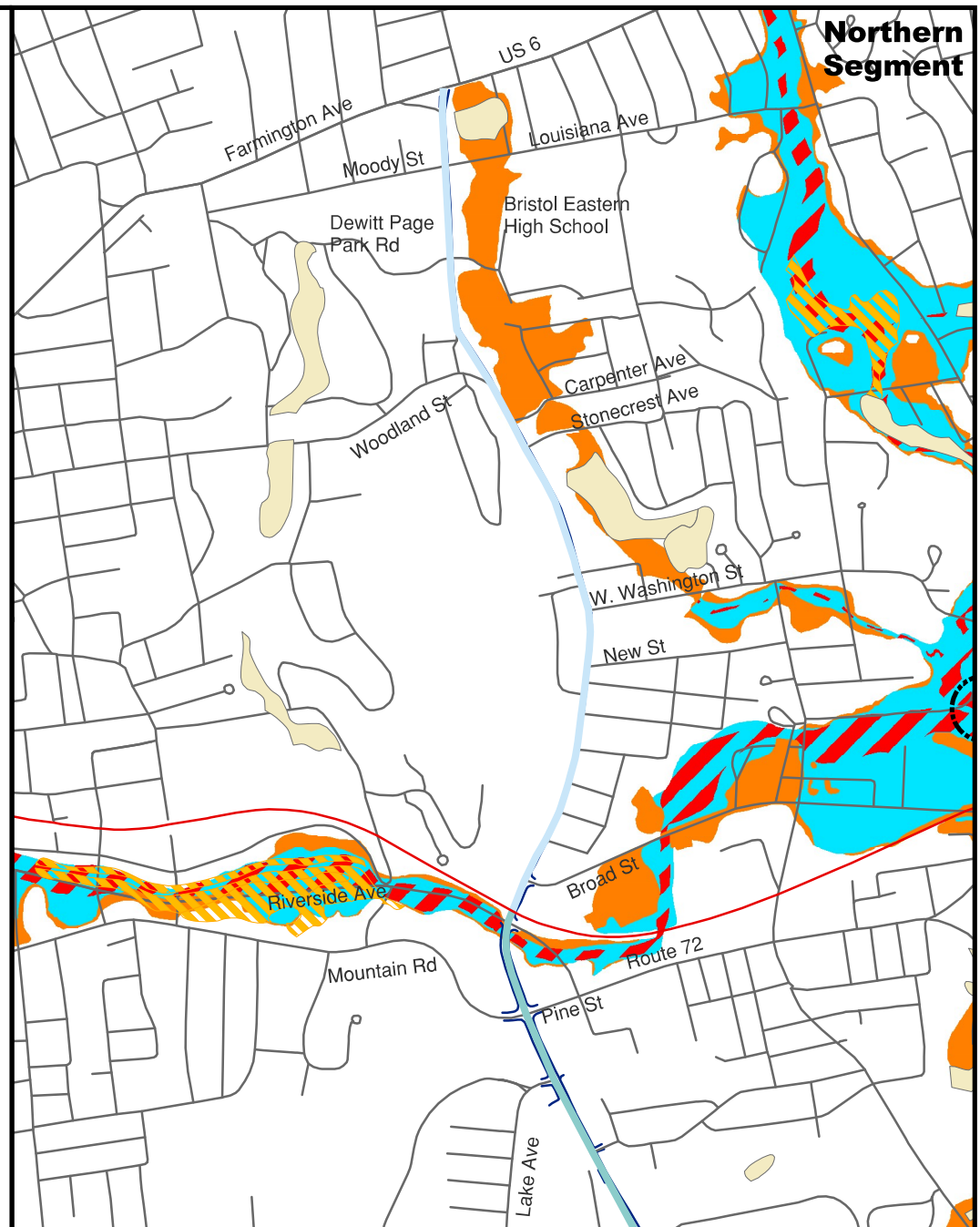
Segments

-  Northern Segment
-  Central Segment
-  Southern Segment
-  CT Roads
-  Sidewalk
-  Town Boundary

Flood Hazard Zones

Zone Type

-  1% Annual Chance Flood Hazard
-  Regulatory Floodway
-  Special Floodway
-  Area of Undetermined Flood Hazard
-  0.2% Annual Chance Flood Hazard
-  Future Conditions 1% Annual Chance Flood Hazard
-  Area with Reduced Risk Due to Levee

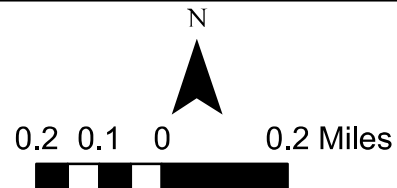


Flood Hazardous Zones

Figure 20

Connecticut Wetland Soils

Significant Natural Community Area



**CT Route 229
Corridor Study**






Northern Segment

Legend

 Natural Diversity Database







Soil Survey Data

CT Wetland Soil Type

-  Alluvial and Floodplain Soils
-  Poorly Drained and Very Poorly Drained Soils
-  CT Rail








Corridor 3 Segments

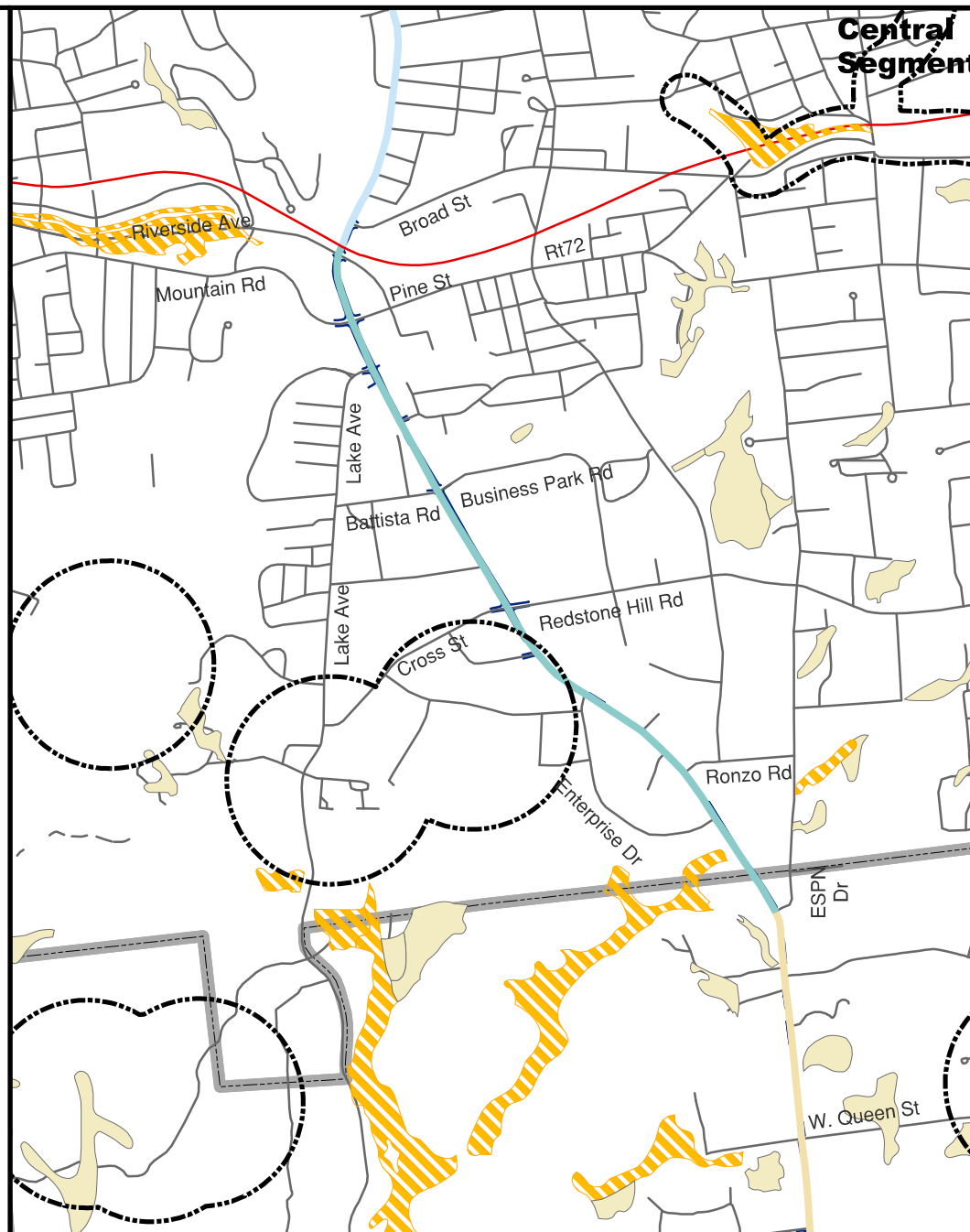
Segments

-  Northern Segment
-  Central Segment
-  Southern Segment
-  CT Roads
-  Sidewalk
-  Town Boundary

Flood Hazard Zones

Zone Type

-  1% Annual Chance Flood Hazard
-  Regulatory Floodway
-  Special Floodway
-  Area of Undetermined Flood Hazard
-  0.2% Annual Chance Flood Hazard
-  Future Conditions 1% Annual Chance Flood Hazard
-  Area with Reduced Risk Due to Levee

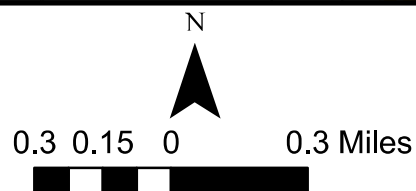


Flood Hazardous Zones

Figure 21

Connecticut Wetland Soils

Significant Natural Community Area



**CT Route 229
Corridor Study**






Central Segment

Legend

 Natural Diversity Database







Soil Survey Data

CT Wetland Soil Type

-  Alluvial and Floodplain Soils
-  Poorly Drained and Very Poorly Drained Soils
-  CT Rail








Corridor 3 Segments

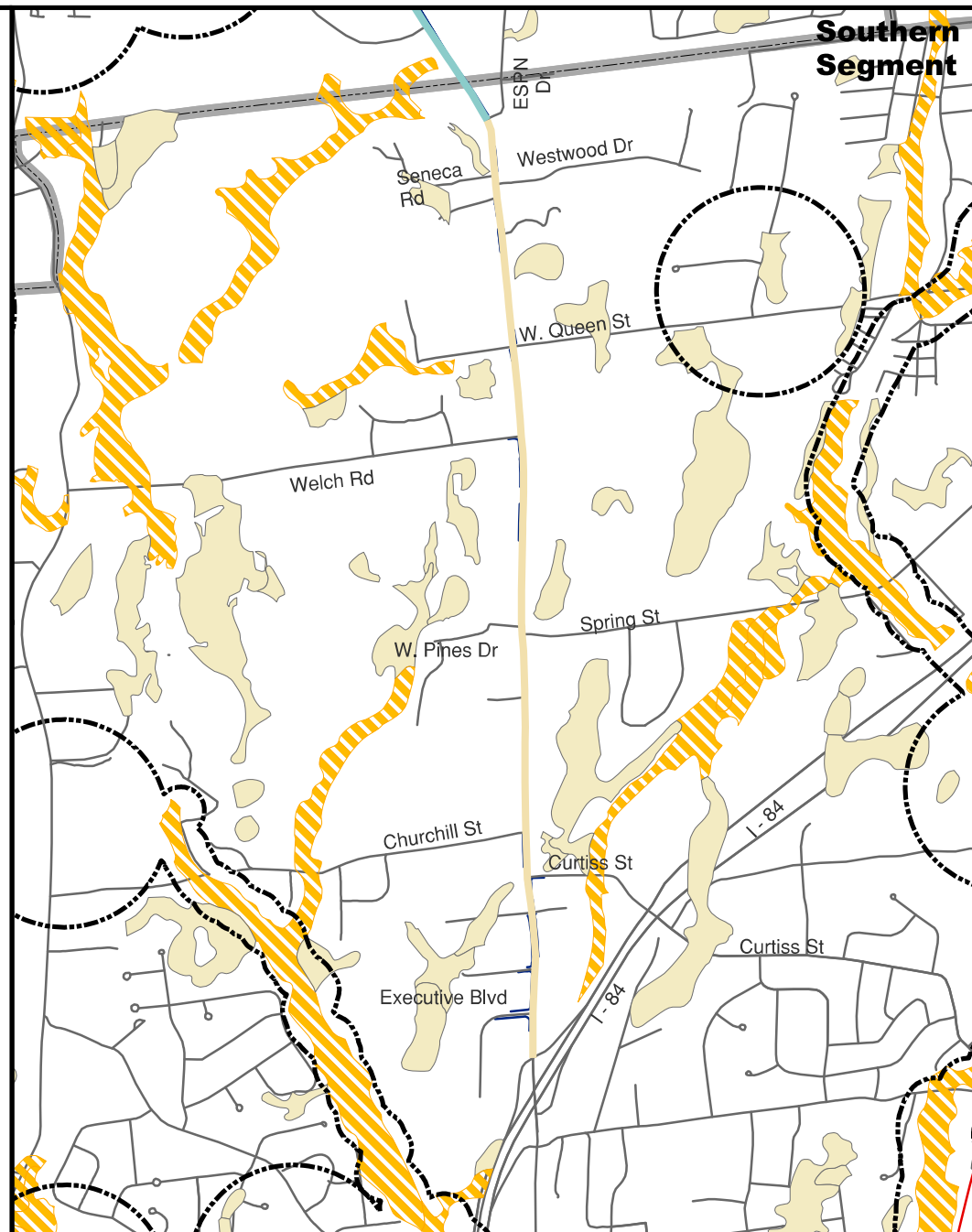
Segments

-  Northern Segment
-  Central Segment
-  Southern Segment
-  CT Roads
-  Sidewalk
-  Town Boundary

Flood Hazard Zones

Zone Type

-  1% Annual Chance Flood Hazard
-  Regulatory Floodway
-  Special Floodway
-  Area of Undetermined Flood Hazard
-  0.2% Annual Chance Flood Hazard
-  Future Conditions 1% Annual Chance Flood Hazard
-  Area with Reduced Risk Due to Levee

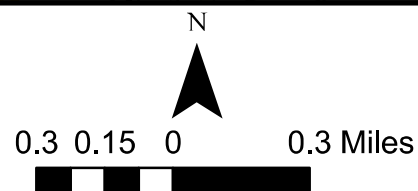


Flood Hazardous Zones

Figure 22

Connecticut Wetland Soils

Significant Natural Community Area



**CT Route 229
Corridor Study**



Southern Segment

Threatened and Endangered Species and Critical Habitats

Rare, threatened, and endangered species are protected by federal and state legislation. Information on species designated (listed) as threatened and endangered at the state and federal levels is compiled and made available through CTDEEP's Natural Diversity Data Base (NDDDB).

The CTDEEP NDDDB GIS data layer was consulted to determine if there were any records in the Study Area. Due to the sensitivity of the information, the GIS data layer only depicts approximate locations of protected species, their habitats, and / or significant natural communities. The layer is updated every six months and reflects information that has been submitted and accepted up to that point. The last recorded update to the GIS file was done on 6/15/2020. The GIS data review revealed a NDDDB listed "Significant Natural Community Area" in proximity of the CT Route 229. [Figure 20](#) through [Figure 22](#) also includes the natural diversity data layer.

Hazardous Risk Site

Data sources that were reviewed to identify potential hazardous materials and environmental risk sites within the Study Area include:

- The Environmental Protection Agency's (EPA) Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) GIS database,
- CTDEEP's List of Contaminated or Potentially Contaminated Sites,
- CT DEEP's Brownfields Inventory, and
- CTDEEP's Landfill Leachate and Wastewater Discharges GIS data.
- NVCOC's the West-Central CT Brownfield Partnership Data

CTDEEP's List of Contaminated or Potentially Contaminated Sites (Dated 09/08/20) identified 58 sites within the Study Area. These sites can be grouped into seven types with various stages of remediation. A complete list can be found in the [Appendix D](#).

A site in Bristol, formerly Superior Electric and currently ESPN North campus at 383 Middle Street has been identified as Superfund Site under EPA's CERCLIS database. At this site, hazardous waste may have been released to the environment. Prior to ESPN occupancy, remediation work of the site has begun and continues.

There are no sites within the Study Area identified in CTDEEP's Brownfields Inventory. Additionally, there are no listed CTDEEP Landfill Leachate and Wastewater Discharges in the Study Area.

Historically and Culturally Significant Resources

The City of Bristol was established in 1645 with the first deed signed in 1650. The first settler was Daniel Brownson, who built a house near West Street, however the first permanent settler was Ebenezer Barnes, who built a home on King Street. By 1728 Nehemiah Manross built a house north of Barnes Street, on the west side of King Street followed by additional settlers at what is now known as East Bristol. In 1911 the Town of Bristol was incorporated as a City. Today, Bristol is mostly residential and best known as the home of ESPN, the American Clock & Watch Museum (opened in 1952), and Lake Compounce, America's oldest continuously operating theme park - opened in 1846.

The Town of Southington was established as a town in 1779, when it was separated from Farmington. It remains a suburban community with few industrial developments during the industrial revolution era. In the early 1900s, Southington developed as a manufacturing center, but still maintained a very small population of a few thousand residents. Samuel Woodruff was the first settler who moved south from Farmington to the area then known as Panthorne. The settlement grew and came to be known as South Farmington, and later, the shortened version, Southington.

Both communities' lands were formerly occupied by the Tunxis or Sepores Indians.

There are three properties listed on the National Register of Historic Places within the project Study Area. These include:

Lake Compounce and the Carousel

The carousel is a part of Lake Compounce Amusement Park, the oldest, continuously operating park in the United States. The carousel was designed by Charles I. D. Loeff and built in 1890. The Carousel officially became added to the National Register of Historic Places in 1978.

What Is Section 4(f) and Section 6(f)?

Section 4(f) is the strongest federal preservation law on the books. This law, which is part of the Department of Transportation Act of 1966, 49 U.S.C. § 303, requires transportation agencies to avoid harming historic places unless there is no "feasible and prudent" alternative to doing so.

Under **Section 6(f)**, it is prohibited to convert property acquired or developed with LWCF (Land and Water Conservation Fund Act) grant money to non-recreational purposes without approval from the National Park Service (NPS).



Image source: https://en.wikipedia.org/wiki/Lake_Compound_Carousel

Figure 23 Lake Compound and Carousel

Terry-Hayden House

The property is located at 125-135 Middle Street in Bristol. It was originally built by Theodore Terry, who ran a clock factory, in 1850. The house was then expanded upon by the next owner, Henry Mitchell. The house was eventually purchased by Leonard Hayden in 1899, whose family owned the property into the 1980s. The house was named on the National Register of Historic Places in 1982.

Figure 24 illustrates the front of the historical house. Currently the building is incorporated as part of professional office complex called Terry Commons.



Image source:
https://en.wikipedia.org/wiki/Terry-Hayden_House

Figure 24 Terry-Hayden House

West Street School

The one room schoolhouse located on 1432 West Street in Southington was originally built in 1760 and acted as the school for the northwest portion of the Town until 1946. The school still has its original 18th century exterior and 19th century interior with a wood stove. The school is currently maintained by the Southington Historical Society.



Image source: <https://historicbuildingsct.com/west-street-school-1760>

Figure 25 West Street School

Along the corridor there are several parks and natural features that can be classified of cultural significance. These include:

- **Page Park** – Gifted to the City of Bristol by the DeWitt and May Rockwell Page family in 1933, the park serves residents as a local recreational area with a basketball court, baseball and softball fields, tennis courts, and the Page Park lagoon. Located across from Bristol Eastern High School, it can be accessed via King Street, Moody Street, Page Avenue, and Woodland Street.
- **Casey Park** – is a small local park created via transfer deed from the Sewer Department to Bristol Parks, Recreation, Youth and Community Services in 1950. Named for the former Mayor of the City James P. Casey. It features a softball field, volleyball, basketball courts, and a small-scale football field.
- **Hurley Hill** in Bristol is a large undeveloped piece of land to the west of the corridor and in the northern segment. There are no official trails. Hurley Hill is simply natural land with large elevation differences.
- **Great Unconformity** on Southington Mountain although not located in the corridor it can be observed from the distance to the west of the corridor. The “unconformity” referenced in the name denotes to the geological makeup of the rock formation of the waterfall. Along the banks of the stream, one can observe two unique rock layers. One layer is primarily grainy schist, while the upper layer is primarily a lumpy conglomerate. In addition, a Hushak Rock, known informally for decades as White Rock provides an expansive view of the region and can be seen from much of CT Route 229 and area neighborhoods. The state of Connecticut officially named Hushak Rock in 2017 for longtime Southington civic leader and World War II pilot Walter J. Hushak.
- **The Middle Street Dam** has been investigated and determined it no longer serves any function and offers no historic nor aesthetic value. The current dam was built in the late 1960s by the CTDOT, replacing the original granite dam used to divert water to the Bristol Brass Company. The dam is located at the southwest corner of the

junction of CT Route 72 and CT Route 229 in Bristol. Removing the dam will not impact flooding because it is not a flood control dam.

Multimodal Accommodations

The study team reviewed and assessed the availability and the extent of the existing facilities and accommodations in the study corridor that supports alternative modes of transportation and their features:

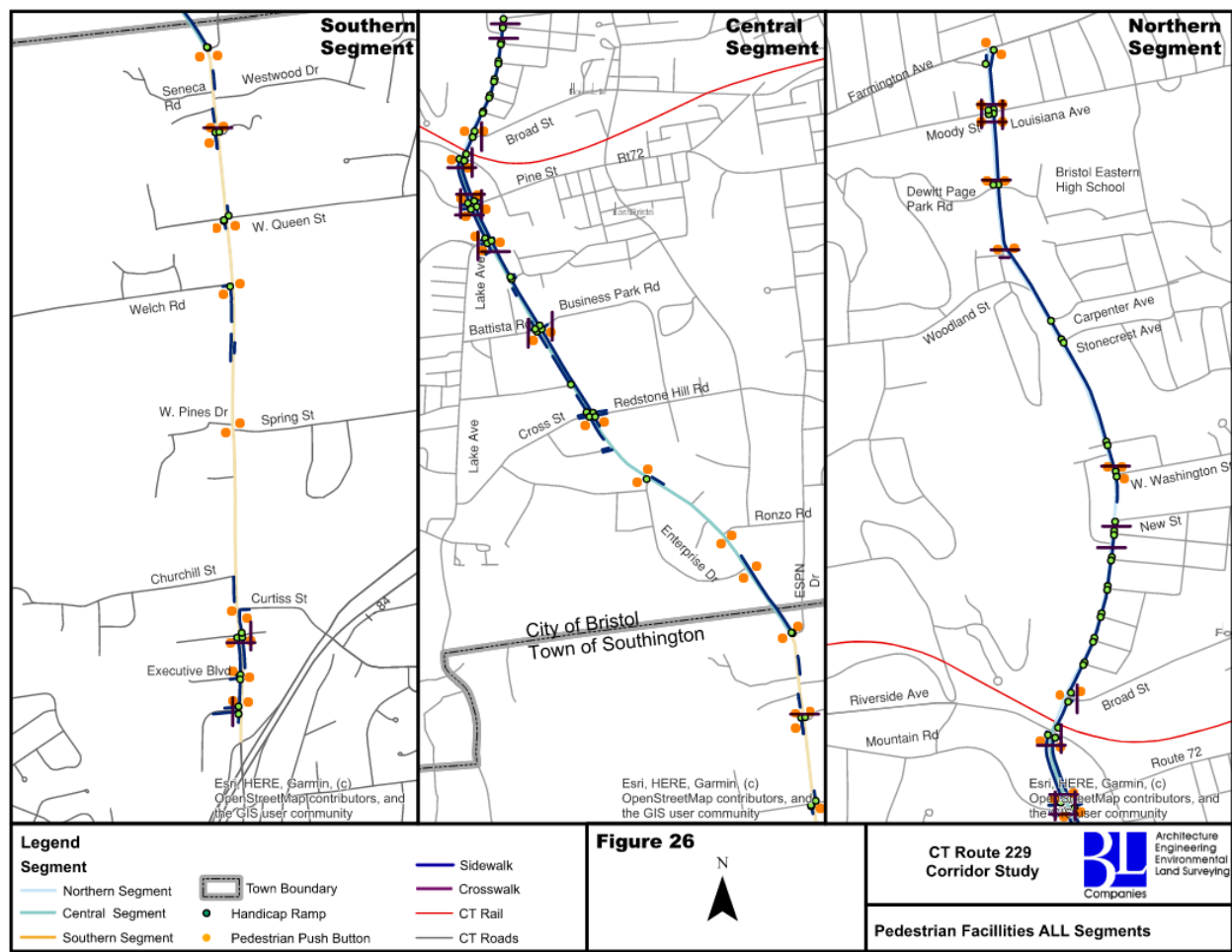
- Pedestrian Facilities
- Bicycle Facilities
- Transit Services
- ADA compliance
- Park and Ride Facilities

The Study Area is typical of a low-to-medium density suburban setting. The study corridor lacks continuous sidewalk. Pedestrians are often forced to walk in the shoulder of the roadway or on lawns. Cyclists ride on the shoulder as delineated on-street bicycle facilities are not available for their use. The limited bicycle and pedestrian facilities within the Study Area act to discourage, rather than encourage, non-motorized travel.

Pedestrian Facilities

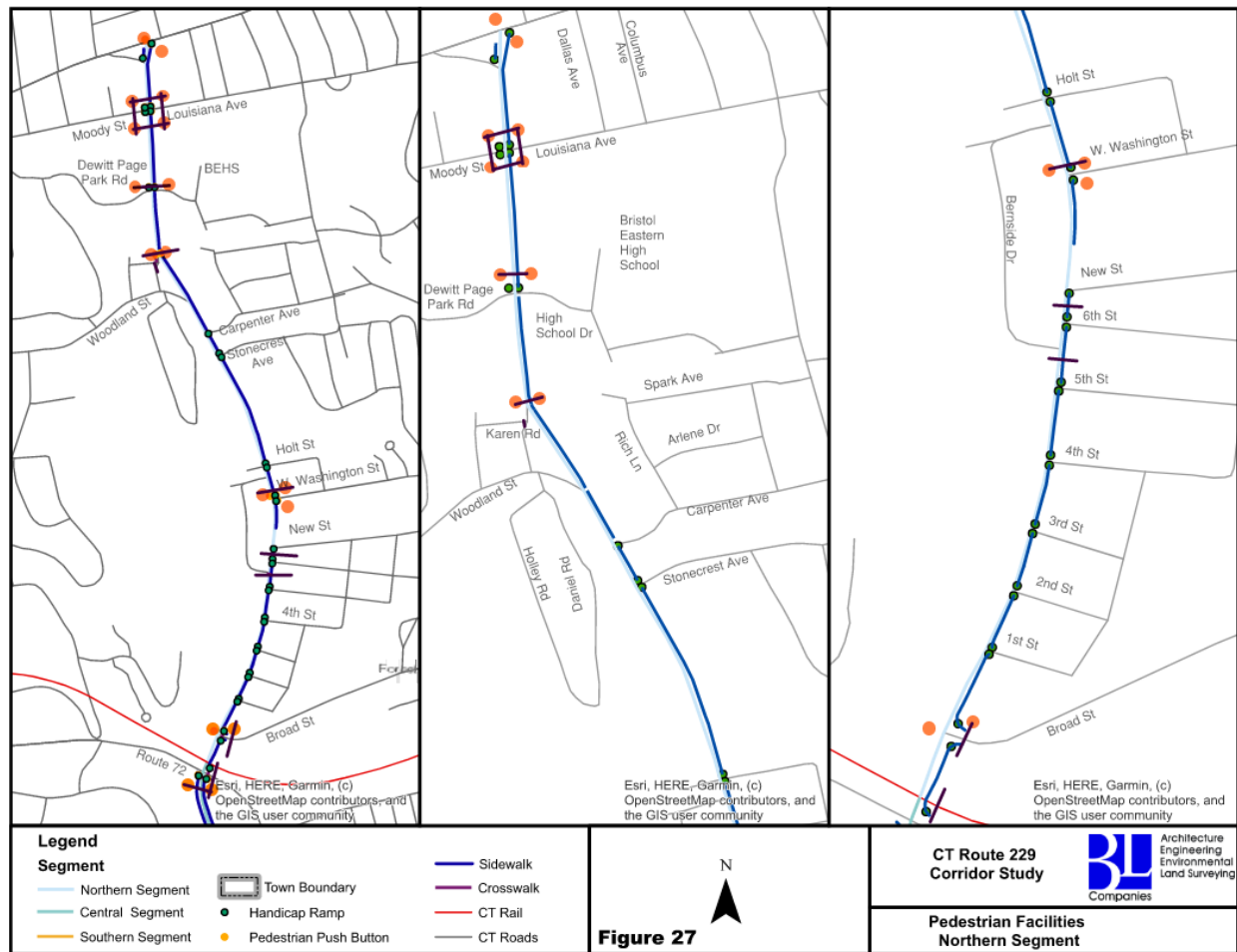
While portions of the corridor are suburban in nature, the study corridor generally has limited sidewalks. Other pedestrian facilities are limited to incomplete sets of pedestrian actuated intersection crossings, and limited pedestrian push buttons that are not accessible to people with disabilities. Approximately 40% of the roadside along CT Route 229 has public sidewalks (4.4 miles of sidewalk out of total roadside length of 11.2 miles within the Study Area). Most of these facilities are located between Cross Street / Redstone Hill Road intersection and Farmington Avenue. [Figure 26](#) illustrates pedestrian facilities by three segments and [Figure 27](#) through [Figure 29](#) are zoomed in view for each segment.

Figure 26 Pedestrian Facilities



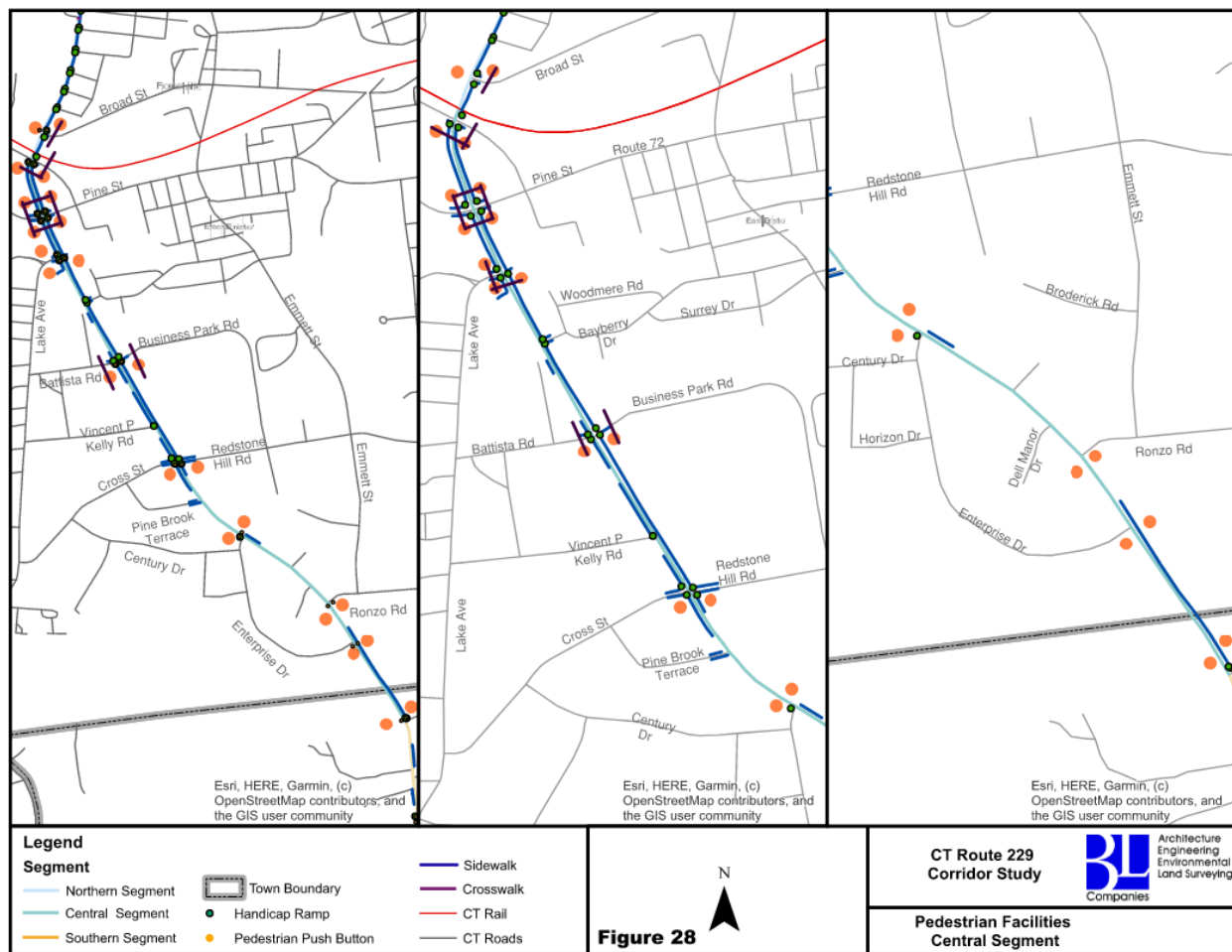
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Figure 27 Pedestrian Facilities Northern Segment



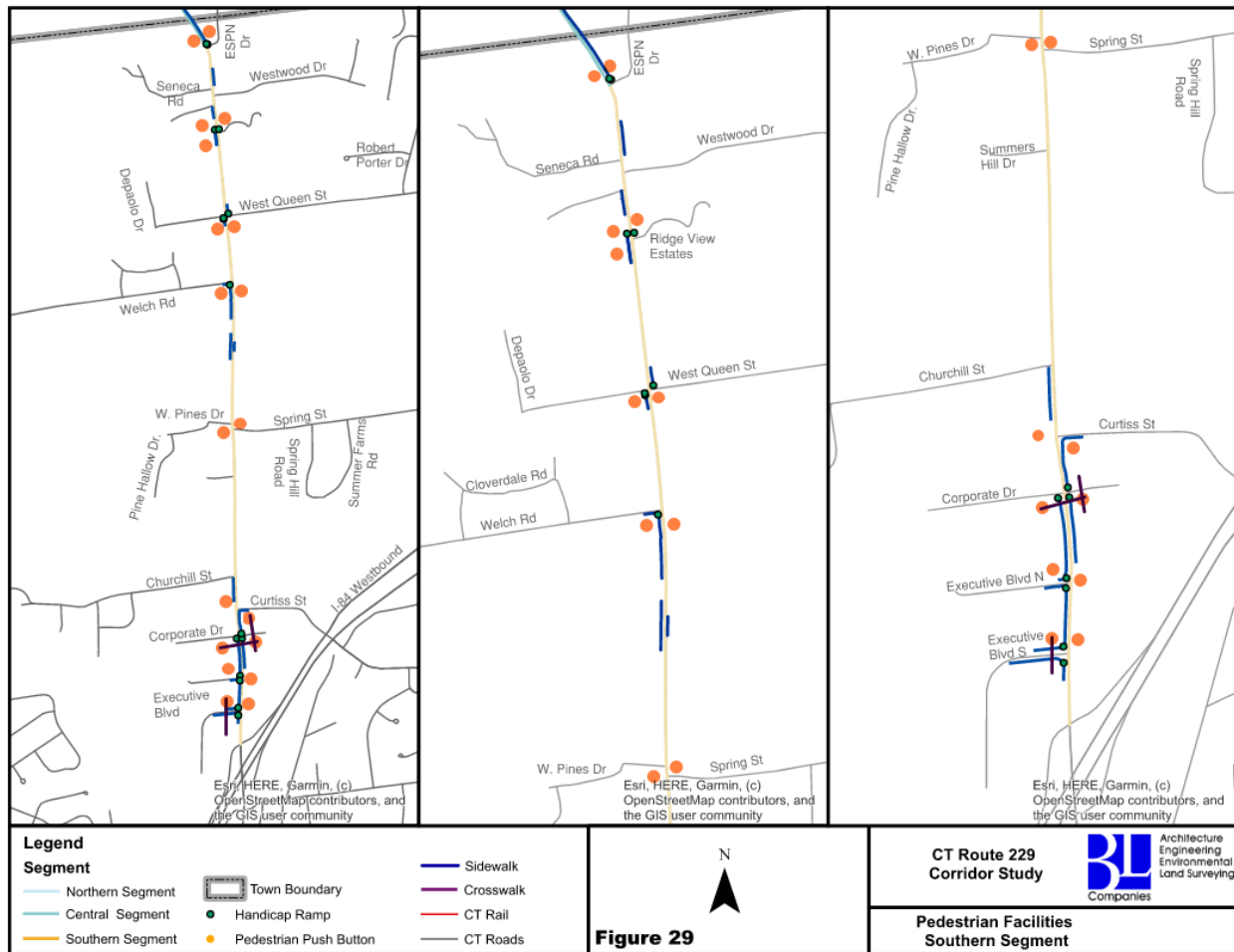
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Figure 28 Pedestrian Facilities Central Segment



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Figure 29 Pedestrian Facilities Southern Segment



Please note, actual map
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Segment 1: West Street

The southern portion of the corridor is generally unsuitable to pedestrians whether they are walking along West Street or attempting to cross the corridor due to the lack of sidewalks, ramps, and exclusive pedestrian phases in the traffic signal programs. There are only four crosswalk locations through this segment of the corridor. One crosswalk is located at the intersection with the Executive Boulevard Shopping Plaza near the I-84 ramps and provides delineated crossing across Executive Blvd South. Two crosswalks are located at the intersection of Corporate Drive on the south and east leg of the intersection. A fourth crosswalk is located on the north leg of the intersection of West Street and Ridgeview Village and Cumberland Farms Driveway. Sidewalk segments can be found at newly develop parcels throughout the corridor, including the shopping center between Corporate Drive and Executive Boulevard Drive South, in front of Geremia Gardens located south of Welch Street, by the Dollar General Store, and Cumberland Farms gas station. At every signalized intersection, there is at least one push button for pedestrians on east and west side of the West Street, however many of these push buttons are not accessible to people with disabilities.

Segment 2: Middle Street

The central section of the corridor continues with an intimidating environment for pedestrians until south of the intersection with Cross Street and Redstone Hill Road. From this intersection, traveling northerly, there is a continuous sidewalk to the east of Middle Street until the New Street intersection (beyond the central section) where it ends suddenly, leaving the pedestrian with no way to safely continue along their path and disrupting the network. Few intersections provide sidewalks, ramps, crossing on both sides of the roadway. Similarly, push buttons to activate exclusive pedestrian phase are not always accessible to people with disabilities, however one on each side of Middle Street is available. Although handicap ramps are available at most end points of sidewalks, they do not meet the Americans with Disabilities Act of 1990 standards. [Appendix E](#) contains GIS figures with detailed assessment of conditions. There are ten crosswalks through this segment of the corridor. Only the intersection with Pine Street and Mountain Road has four crosswalks across all legs on the intersection. Two intersections, the Riverside Road intersection and Lake Avenue intersection, provide east-west and north-south crossing, meaning one crosswalk across CT Route 229 and one crosswalk across minor roadway. Last, the intersection with Battisto Road and Business Park Road provides two crossing that are north-south connections for the existing sidewalks.

Segment 3: King Street

The northern segment from Broad Street to Farmington Avenue has almost continuous sidewalk on the east side of King Street. A small stretch of 175+/- feet between New Street and West Washington Street does not provide any type of pedestrian access. Photo 8

illustrates the worn path, from pedestrians continuing to connect with the next segment of sidewalk, stressing the importance of providing the missing segment of sidewalk.



Photo 8 Worn Path example North of New Street

Pedestrian Safety

Safety is one of the most important elements that make for a pedestrian-friendly environment. Various types of crosswalks are one of the most commonly used tools to increase pedestrian safety. These types include traditional white painted crossings, crossings that utilize specialized paving, or crossings that clearly mark the entire intersection using white stripes. Another element often utilized is signalized crossings which more formally regulate the interactions between the pedestrian and the motorist.

About a third of the signalized intersections along the Study Area include crosswalks across CT Route 229. While many of these crosswalks are located in areas with higher levels of pedestrian traffic, there were five (5) crashes involving pedestrians in these high pedestrian traffic areas. One of these pedestrian crashes resulted in a fatality. These crashes indicate that pedestrian safety is an issue along the corridor. In addition to the real danger that exists, many potential pedestrians can be intimidated by what they may perceive as unsafe and choose not to walk. For example, many pedestrians are intimidated by the wide intersections with significant traffic volumes and little protection as shown Photo 9, regardless of whether or not there are crosswalks.



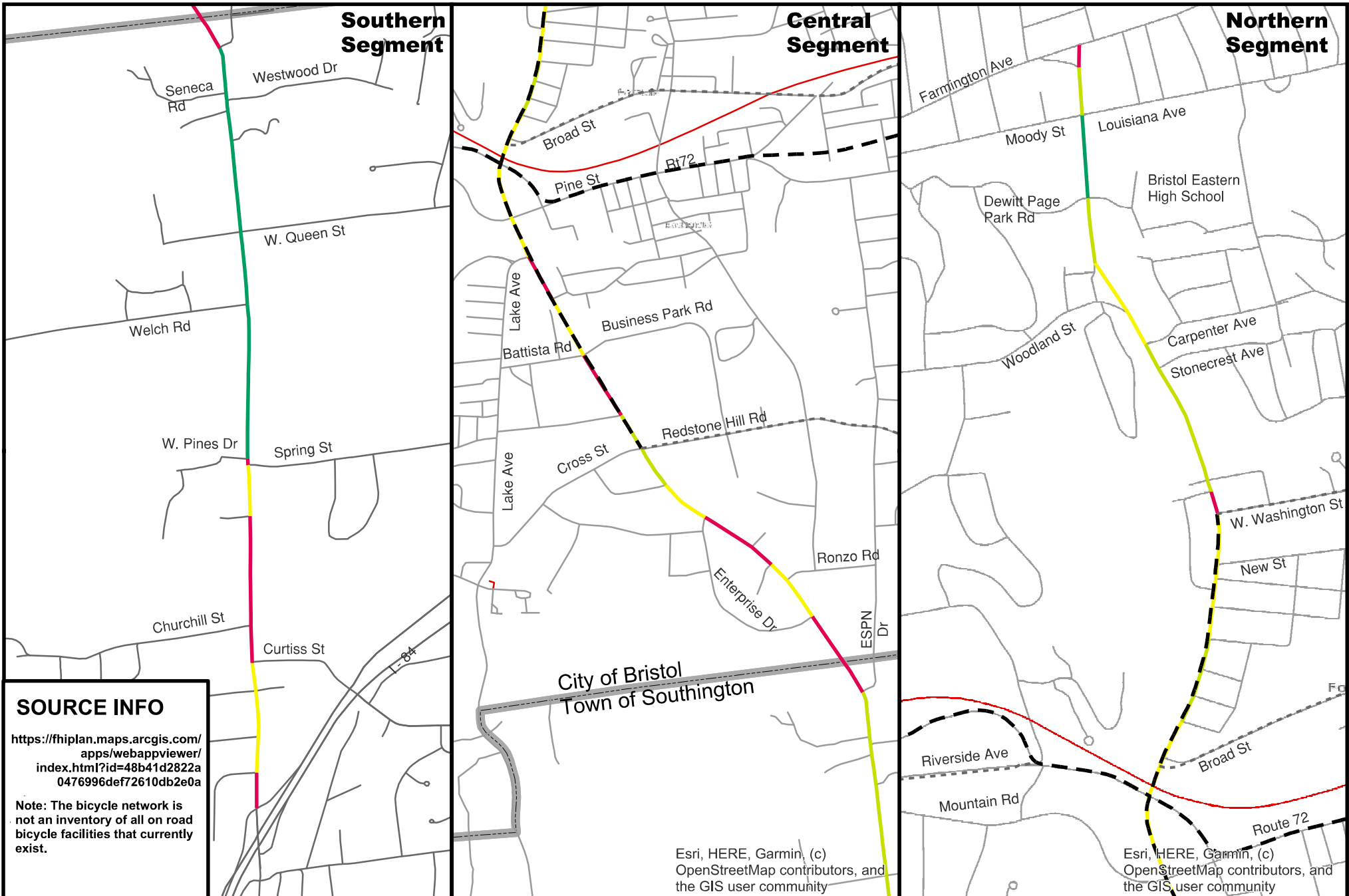
Photo 9 Example of Wide Intersection: Riverside Avenue @ CT Route 229

Bicycle Facilities

While there are currently no dedicated bike lanes, shared used pavement markings, signage, or other facilities for bicyclists along CT Route 229, this mode of transportation has the potential to be utilized in the Study Area. Currently, the bicycle environment is not conducive to attracting cyclists. The corridor is characterized by inconsistent shoulder widths, numerous intersecting roadways and driveways, constant streams of traffic that travel at high speeds, steep grade and a lack of “share the road” signage or other devices that would alert drivers of the potential to encounter a bicyclist.

CTDOT has generated a new tool “Connecticut Interactive Bike Map” for planning and design suitability. [Figure 30](#) illustrates suitability of the corridor for bicycling. There are four classification codes for each segment of the roadway. The scoring is based on Average Daily Traffic (ADT) and shoulder width. Red segments are the least suitable for bicycling while green segments are most favorable with wide shoulders and low ADTs. CT Route 229 through the Study Area is mostly yellow, orange, and red with a few segments of green. CTDOT also generated an “On Road Bicycle Planning Network Layer” to identify segments of roadway throughout the state and to provide guidance where CTDOT future improvements should occur. [Figure 31](#) illustrates the CT Route 229 segment between

Redstone Hill Road and West Washington Street is identified for further development. CTDOT has developed a three-tier system to identify priorities in the bicycle planning network. Between Redstone Hill Road and Woodland Street, CT Route 229 has been identified with implementation Tier II segments. This category identifies segments that are less critical but recommend bicycle improvements be considered for incorporation into existing maintenance and operations other road work. It should be noted, Riverside Avenue (CT Route 72) to the East of CT Route 229 has been identified as Tier I, which are those segments with bicycle safety concerns and may be considered for stand-alone bicycle improvements projects. Although there is a Farmington Canal Heritage Trail (FCHT), a multi-modal facility in proximity to the Study Area, bicycle infrastructure, such as bicycle lanes and bicycle racks, is noticeably lacking on CT Route 229. The FCHT is located to the east of the corridor and with the proposed Gap Closure Study findings, the trail may extend north from its current terminus at Lazy Lane into Plainville into Plainville and Southington. In addition, the southern part of the Tunxis Trail, a 79-mile blue-blazed trail, runs from the Wolcott line atop South Mountain north through Southington to Bristol. This trail currently ends at the park and ride lot on Lake Avenue.



LEGEND

Bike Feature Suitability

- Least Suitable
- Less Suitable
- More Suitable
- Suitable

- On-State Road Bike Network
- On-Town Road Bike Network
- CT Rail
- CT Road
- Town Boundary

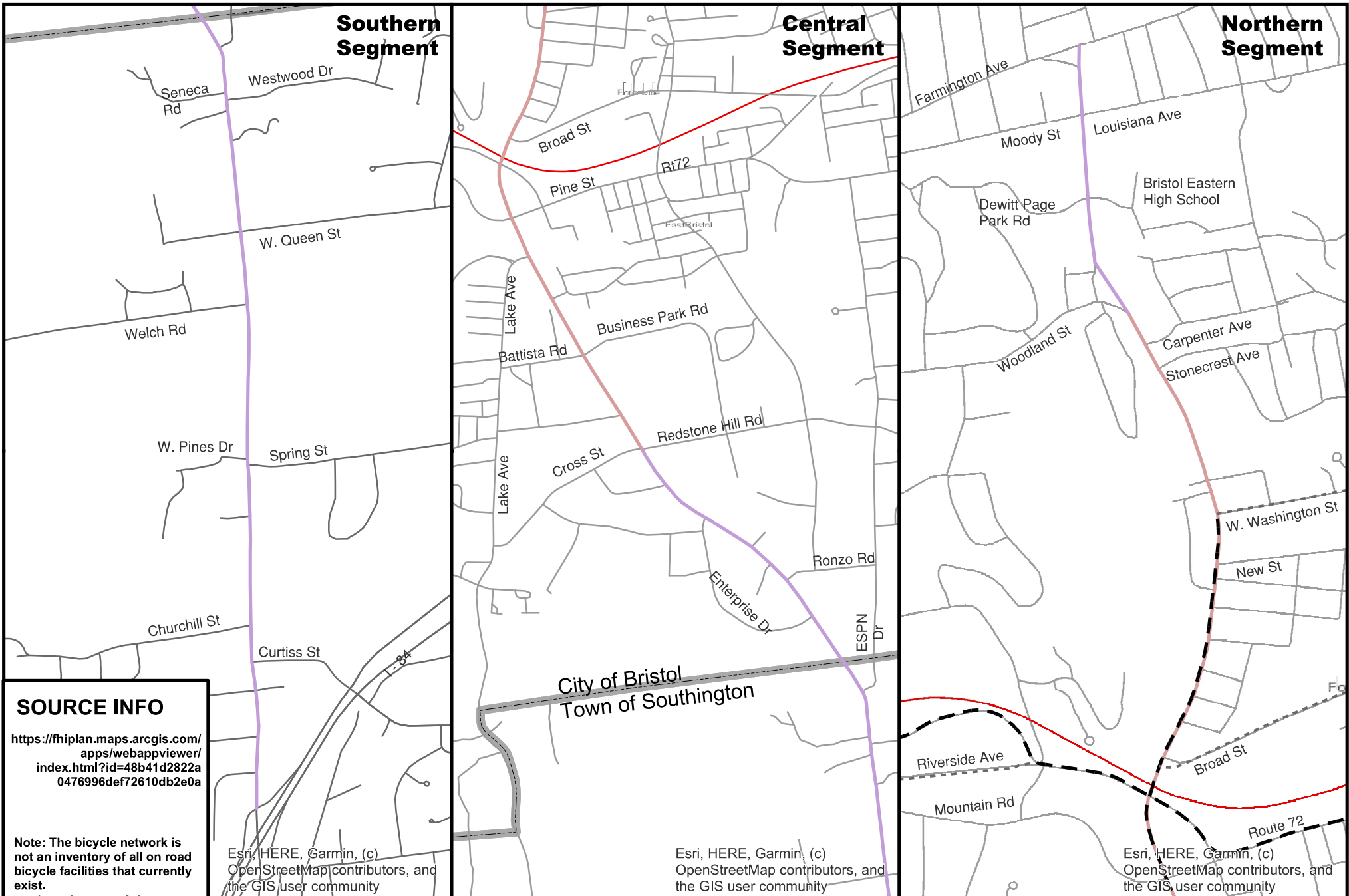


Figure 30

CT ROUTE 229 CORRIDOR STUDY
BRISTOL / SOUTHTON



**Bicycle Network Plan
Existing Suitability**



<p>Bike Feature</p> <p>ImptTier</p> <p>— No Plans</p> <p>— Tier II-1 to Tier II-5</p> <p>— Tier III-3</p>	<p> Town Boundary</p> <p> On-State Road Bike Network</p> <p> On-Town Road Bike Network</p> <p> CTRail</p> <p> CT Road</p>	<p>N</p> <p>Figure 31</p>	<p>CT ROUTE 229 CORRIDOR STUDY BRISTOL / SOUTHTON</p> <p> Architecture Engineering Environmental Land Surveying Companies</p> <p>CTDOT On Road Bicycle Planning Network and Tier of Implementation</p>
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Transit Services

CTtransit's New Britain-Bristol Division operates 12 fixed-route bus lines that serve New Britain, Bristol, Plainville, and Berlin, with connections to neighboring communities. CTfastrak buses also operate near the area and provide direct connection to Hartford. Only three of these routes: 102, 502 and 541 operate within the vicinity of CT Route 229 corridor. These three local bus routes make frequent stops, typically every two to three blocks, linking neighborhoods with urban centers and providing connections within and between communities. Although individual trips on some local buses operated in a limited - or skip - stop fashion, local bus routes primarily serve city streets and may also operate on mall, hospital or shopping center properties.

102 Hartford / New Britain / Bristol is a CTfastrak branded bus route that operates primarily between downtown Hartford and downtown New Britain with limited stops along Farmington Avenue in Hartford, all CTfastrak stations, and along CT Route 72. From New Britain, Route 102 continues on semi-express path to Plainville Center and downtown Bristol via CT-72. Bus stops near the corridor can be found on Mountain Road, Pine Street, and at the Lake Avenue Park and Ride lot with limited amenities. This route operates seven days a week (Monday through Sunday) with limited stops on the weekend. The average weekday daily ridership in 2019 totaled 1,294 boardings and alightings. Three percent (3%) of daily trips board and alight within 0.5 miles of CT Route 229.

502 Block Rock Avenue operates between Bristol and New Britain with 47 stops. Its path starts in New Britain at the CTfastrak Hub on Columbus Blvd and continues westerly through Plainville, Forestville, and Bristol. In Bristol, near the CT Route 229 Study Area, the bus route follows CT Route 72 (Pine Street and Mountain Road). Bus stops are marked with a shield on a utility pole or signpost with no bus shelters. The average weekday daily ridership in 2019 totaled 210 boardings and alightings. Three percent (3%) of daily trips board and alight within 0.5 miles of CT Route 229.

541 Bristol Local also known as "Tunxis Community College route" operates mainly along US Route 6 / Farmington Avenue, connecting Bristol downtown with the school. In total there are seven stops with a transfer point at Bristol City Hall at North Main Street and Laurel Street. Connections can be made to routes: 102, 502, 542, 543, and 923. The Tunxis Community College stop also provides a transfer point for bus route 66 and 503. The route operates seven days a week with weekday and weekend schedules. The average weekday daily ridership in 2019 totaled 270 boardings and alightings. Because the bus route circulates around Bristol Plaza, the nearby bus stops account for approximately twenty percent (20%) of average weekday daily bus ridership.

CTtransit only operates fixed-route service. While all CTtransit buses are wheelchair accessible with wheelchair lifts or ramps for access by persons with disabilities, FTA regulations require complementary ADA services be provided. For the Bristol-New Britain

district, the complementary ADA paratransit service is operated by the Greater Hartford Transit District (GHTD) under contract with the CTDOT. The paratransit service is designed to provide those persons with disabilities equal access to public transportation; however, the service is limited to within $\frac{3}{4}$ mile radius of the fixed route public transit service. The paratransit transportation services are designed for individuals who, because of their disability, are unable to travel on the fixed route public transit service operated by CTtransit. The ADA paratransit is available seven days per week during the same operating hours as the fixed route bus. . Since there are no bus routes in Southington and the fix bus routes on CT Route 72 in Bristol are more than $\frac{3}{4}$ miles away from the Southington town line, there are no paratransit services available. Outside of CTtransit services, Dial-A-Ride does provide public transportation for those in need from Southington Calendar House.

CTtransit tickets can be purchased at ticket vending machines, from the bus drivers, and online. A new method of payment was introduced in 2018 with Go CT Card; it provides the same discounts as the multi-ride and / or monthly pass, but the card and funds on the card will never expire. The algorithm behind Go CT Card will determine best possible discount to be provided to transit rider. The adult cash fare for a single ride on all CTtransit local bus service is \$1.75. Transfers are free with a transfer slip for up to two hours from the time they are issued and are good for unlimited rides on local CTtransit buses. CTtransit also offers several passes, which are all valid for unlimited rides for the specified number of days beginning on the date of first use. Older adults and people with disabilities who have a Medicare card or state-issued Reduced Fare ID card pay half fare for tickets and passes.

CTtransit maintains a website www.CTtransit.com that provides the most up to date transit information including a central Connecticut region system map, individual route maps and schedules. CTtransit's website also features an online trip planner, which connects to Google Transit thus providing real-time arrival information for CTfastrak routes.

CTTransit Comprehensive Service Analysis

CTDOT in coordination with CRCOG, CTtransit commissioned a comprehensive service analysis, to conduct an inventory of transit needs in the Greater Hartford area and review existing services provided by CTtransit's Hartford Division. The report is a useful planning tool for CTtransit bus service in the New Britain-Bristol Division and neighboring communities. It provides analysis for improved bus transit service in the study area and a potential blueprint for future services. (Any service changes will need to be approved by CTDOT and further subjected to CTtransit's service change process including Title VI analysis, public hearings, and/or technical assessment.) The study has developed a Transit Potential Index. This analysis index is a composite of population and employment densities and serves as an indicator of the viability of fixed-route service in a particular area.

A higher Transit Potential Index score suggests a higher likelihood of generating substantial transit ridership.

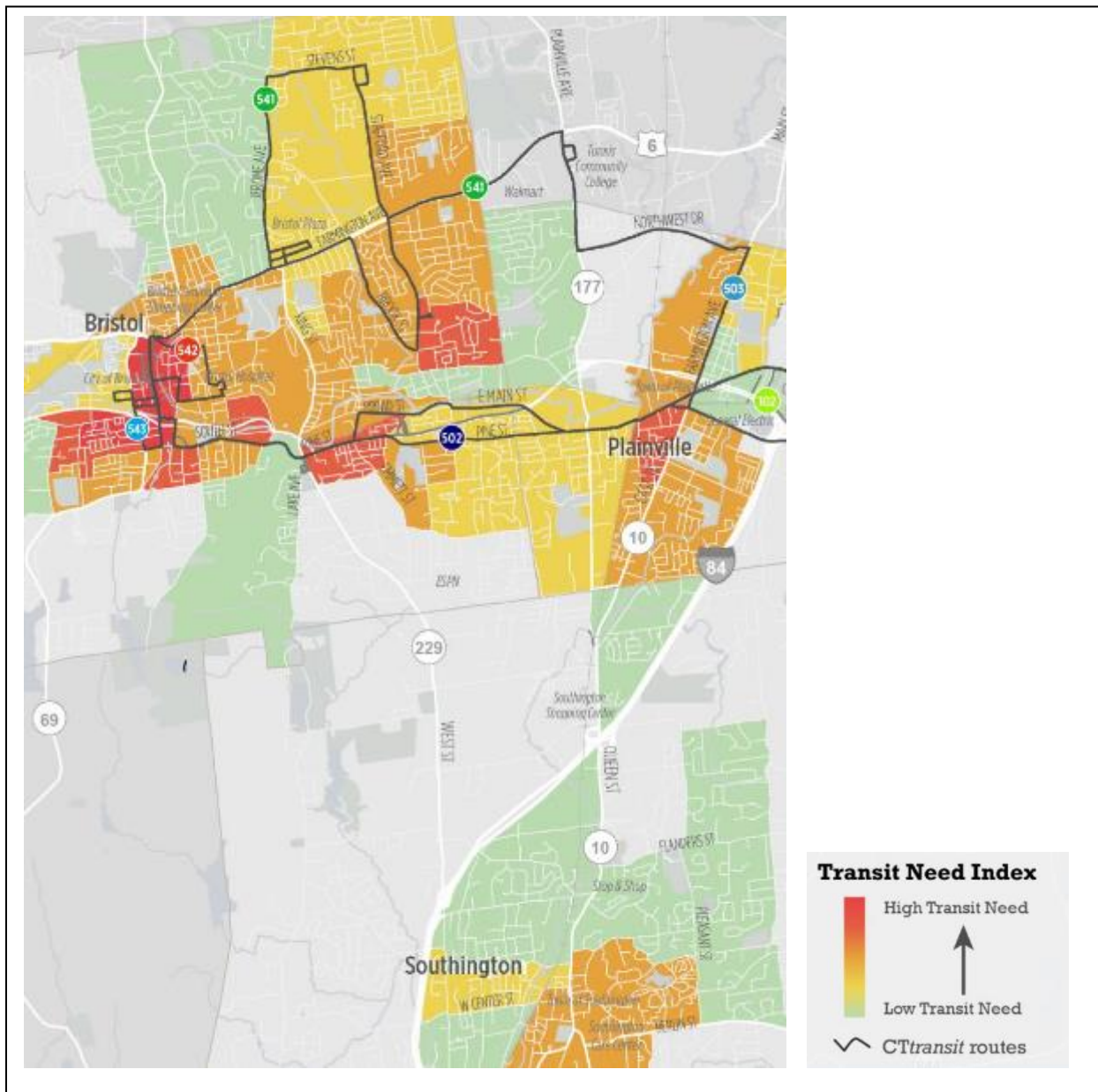


Figure 32 Transit Need Index

Figure 32 Illustrates the potential need to expand transit services in the northern segment of the study area. Areas between Lake Avenue and CT Route 72 heat map indicates “red” color to the east of the corridor, meaning highest possible transit need. Areas between CT Route 72 and Farmington Avenue exhibit “orange” intensity, suggesting there is a latent demand for transit services into the residential areas. Along the corridor, the area between Lake Avenue and I-84 ramps does not provide transit need index information, as there are no current services to include in the assessment of need.

ADA compliance and PROWAG

The Americans with Disabilities Act (ADA) of 1990 requires access to the public right-of-way be provided for people with disabilities and visual impairments. This includes providing accessible sidewalks, street crossings, and pedestrian push buttons at signals. ADA accessibility is a requirement for any project that receives federal funding. Specific ADA accessibility guidelines include:

- Minimum continuous sidewalk widths of 4 feet, with 5 feet of space provided at 200-foot intervals for passing.
- Minimum sidewalk widths maintained without obstruction.
- Curb ramps to transition from sidewalk elevation to street level at crossing locations.
- Detectable warning surfaces on all curb ramps.
- Accessible pedestrian signals that provide non-visual (audible and vibrotactile) queues.
- Accessible pedestrian push button.

Public Right of Way Accessibility Guidelines (PROWAG) are guidelines for physical access for elements located within the public right of way. The public right of way is the roads, sidewalks, and shared-use paths controlled by a public entity. These are currently non-enforceable guidelines; however, PROWAG provides better guidance as a best practice in the absence of enforceable standards. In 2019 the CTDOT issued an Engineering Directive adopting the PROWAG for use in the development of updated accessibility design guidance.

Park & Ride Facilities

A “park & ride” facility is located in the corridor at the northwest corner of intersection of Route 229 / Middle Street and Lake Avenue. The access / egress points are via Sunnydale Avenue, a side road from Lake Avenue. The parking lot is paved, has on street-lighting, and serves 151 vehicles with 145 standard parking spaces and six handicap spaces. This “park & ride” lot is located next to Casey Field and could serve as an overflow lot for local park patrons as illustrated in Photo 10.



Photo 10 Park-n-Ride Facility Location

FUTURE CONDITIONS ASSESSMENT

The purpose of the assessment of the future conditions is to evaluate the potential for economic development within the study area and estimate potential impacts on the transportation system in the future design year (2040). The understanding of the effects potential development could have on traffic growth, traffic operations and mobility in the CT Route 229 corridor allows local, regional, and State officials to make informed decisions about land use proposals and transportation improvements. This technical memorandum assesses the potential for future development, documents the expected traffic growth, resulting traffic operations, and potential changes in transit demand. This document builds off the previously published Existing Conditions Technical Memorandum, which contains a more thorough introduction of the study. It can be found on the study website:

<https://nvcogct.gov/project/current-projects/transportation-planning-studies/bristol-route-229-corridor-study/>

Public Survey

A public survey was conducted to determine public interest in the areas of safety, congestion, and mobility of vehicles, transit system, pedestrians, and bicyclists. In the **Appendix G**, a report outlines the findings of the CT Route 229 Corridor Study Survey conducted in the fall of 2021.

The CT Route 229 Corridor Study Survey generated 20 responses. The responses indicate that the majority of respondents live in the City of Bristol or the Town of Southington and use the corridor a minimum of 4 days a week. Their primary mode of travel is by vehicle to conduct daily business, leisure in the area, commuting to and from work, and connecting to other local networks.

The preferred vision of the corridor should serve both local residents/local businesses and through traffic equally across all three segments. For the corridor improvements, better pedestrian and bicycle accommodations along with safety improvements were preferred along the corridor segments with 40%-75% favorable response. The respondents provided a diverse range of concerns including traffic congestion and safety of the corridor. For the purpose of this report, statements regarding intersections and traffic signalization were categorized under traffic congestion. Respondents were concerned with congestion at intersections; the inability to make a left turn in a timely manner or lack of an exclusive turn lane; speeding through intersections to avoid red lights; ignoring 'No Turn on Red' signs at several intersections, and enforcement of traffic law.

To encourage continued mixed-use development along the corridor while still supporting commercial, industrial, and residential growth, respondents believed that improvements including landscaping and streetscape elements would create a more attractive route.

Additionally, numerous respondents felt that a reimagined CT Route 229, one focused on pedestrian/bicycle friendly elements, would be beneficial. 11% also responded that re-signalization and optimization throughout the corridor was of equal importance.

Future Development Potential

Future economic development potential within the study corridor was assessed under two scenarios, base and build, as defined below:

Base: Considers ambient growth of traffic volumes from development in and around the study corridor area that will occur regardless of actions taken as a result of this study.

Build: Considers additional growth of traffic volumes resulting from development concepts that have been identified by the study team as part of the vision for the corridor.

Base Scenario Development

In order to compile expected developments for the base scenario, the study team worked closely with the CTDOT, NVCOG, and the local stakeholders to identify specific developments that have been approved or planned in and around the study corridor. The identified developments are documented in [Table 17](#), below. While proposals do not always come to fruition as originally intended, the identified developments represent the current planning of the Town of Southington and the City of Bristol for the development or redevelopment of these properties, and potential developers for these sites have already been identified. It is reasonable to conclude, that if any of the proposed developments were to fall through, the two municipalities would work with developers to pursue similar projects at these sites.

Through discussions with the two municipalities' staff, the study team has concluded that each municipality will continue to pursue development opportunities of similar scale at these sites. Therefore, the base scenario and ensuing traffic forecasts continue to include the previously planned development.

Table 17: Base Scenario Developments

Site	Type of Development	Segment	OSTA ID:
1	Bristol Shopping Plaza Land Use Change (Retail to Fast Food with Drive-Thru; Add ATM Kiosk)	Northern	017-2102-01
2	Mitchell Street Mixed Use Subdivision (Mix Use)	Central	017-1908-01
3	Middle Street Industrial Park Exp. (Hotel and Conference Center)	Central	017-2003-01
4	Redstone Hill Road vicinity - Residential Subdivision	Central	No-OSTA ID
5	Land Use Change (Residential to Fast Food / Ice Cream Place; Retail to convenience gas station)	Northern	No-OSTA ID
6	1601 West St – Sports Complex	Southern	No-OSTA ID
7	1303 West St – 240 Apartments	Southern	No-OSTA ID
8	2279 Mount Vernon – (Former Briarwood College) – possible redevelopment / increased use of campus	Southern	No-OSTA ID

Estimation of Growth Rate

There are two prevailing methods in estimating traffic growth rate for traffic impact studies such as the CT Route 229 Corridor Study. These two methods of approach are: Travel Demand Model and Local Transportation Capital Improvement Program (LOTICIP) Growth Rate Estimation.

Travel Demand Model

Travel Demand Models (TDM) are used to forecast traffic flows on the transportation system. Although the transportation system may include other modes of travel such as walking, bicycling, or trains, the models are typically used for evaluating roadway improvements or improvements to bus service. The TDM's main function is to produce long-range traffic forecasts (20-40 years in the future), which are then used in a variety of ways, including supporting the analysis of alternatives, identifying regional capacity needs, and congestion issues. The results of these analyses are important not only in identifying potential highway network needs, but also in providing input for further analysis of traffic flows, including intersection performance on arterial and collector roadways. TDMs are used by consulting firms, metropolitan planning organizations (MPO), and state departments of transportation (DOT) and are the basis for "Certified Traffic" forecasts, pollution emission estimates, and congestion management system statistics.

The CTDOT TDM is a traditional daily four-step travel demand model with trip generation, trip distribution, mode choice, and traffic assignment that reflects population and employment projections and future land use development. These projections are used to predict traffic growth and to show how the transportation network will be impacted by this growth.

Upon consultation with the Connecticut Department of Transportation (CTDOT) Planning Bureau, the 2020 existing traffic volumes were projected to the 2040 design year. On average, the annual growth rate of 0.5% - 1.5 % accounts for normal traffic growth in the corridor.

CTDOT advised the Study Team that the normal traffic growth rates applied to the background volumes (no build) are sufficient to account for growth in the region outside the study area and allow for estimation of growth in the corridor due to proposed developments on the undeveloped parcels.

Only two major traffic generators were coded in future years in TDM by CTDOT. These were:

- Expansion of ESPN campus
- Proposed hotel and conference center at Century Drive

Both projects and land use code were adjusted to reflect the already built-in capacity and parcel utilization.

Furthermore, the TDM does not currently account for any traffic reductions resulting from a considerable number of employees teleworking due to the COVID-19 pandemic. As time passes, the CTDOT-Travel Demand Unit will be reviewing the possible long-term impacts to traffic volumes due to the continued teleworking trend. However, at the time of the writing of this report it is too early to predict what the long term impacts will be.

LOTICIP Growth Rate

Another method of estimating a growth rate in a corridor is to utilize the Local Transportation Capital Improvement Program (LOTICIP) assumption method when establishing future year traffic.

To compute the traffic volumes using the LOTICIP method, the following simple growth factors should be used:

- Within urbanized areas: 0.5% per year (10% growth over 20 years)
- Within rural areas: 1.0% per year (20% growth over 20 years)

This estimate allows a State-funded program for municipalities to perform capital infrastructure improvements with less burdensome requirements than federal aid and to minimize the number and level of State resources (staff) involved in the oversight of municipal infrastructure improvements.

Utilizing the LOTICIP method for the study area, the 2040 background traffic volume growth was projected in a range of 15-30% over the 20 years.

Build Scenario Development

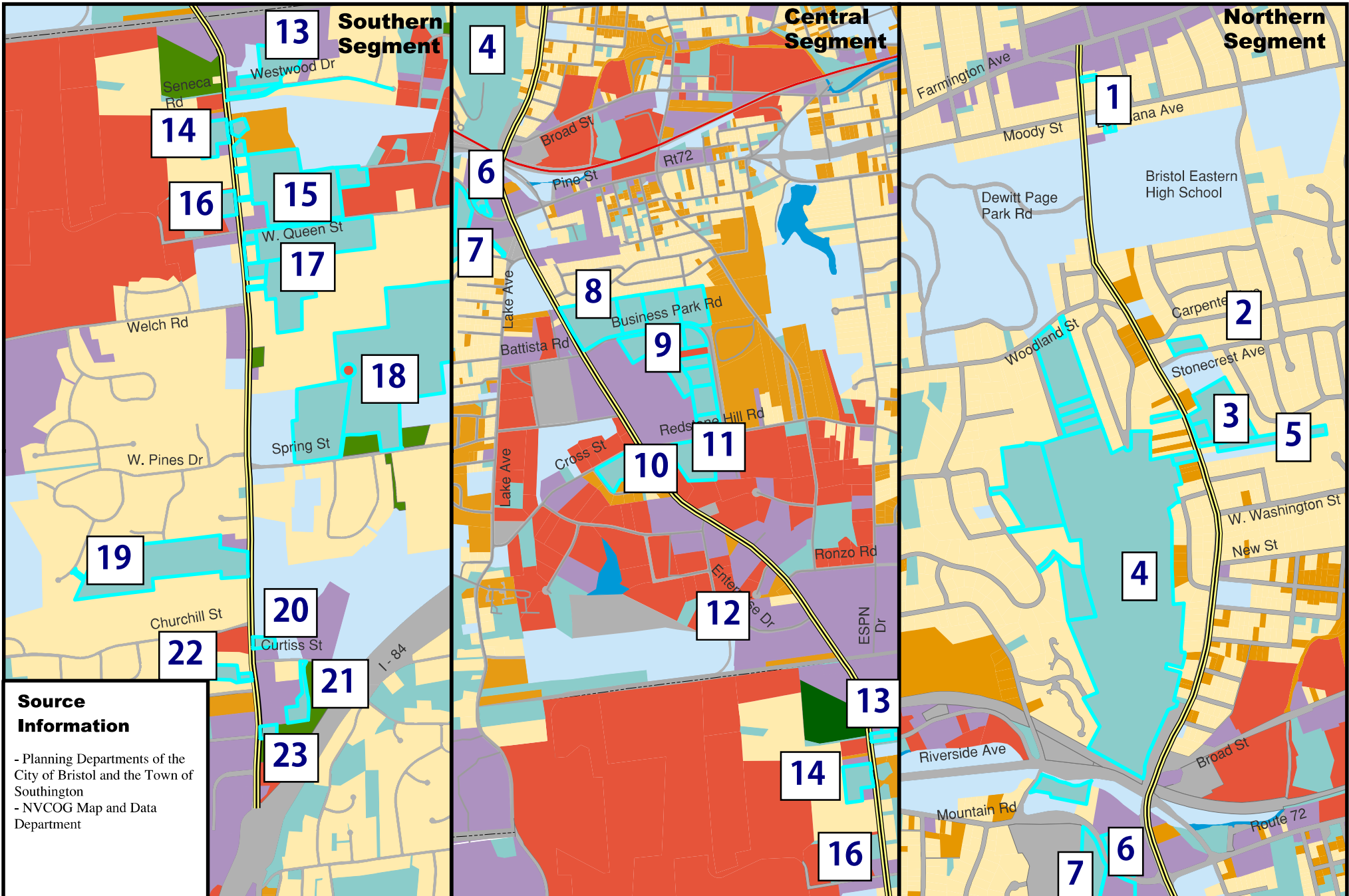
Trip Generation

The study team worked with NVCOG and the municipal representatives to identify additional development or redevelopment opportunities that would impact the traffic within the study corridor. A development scheme was proposed consistent with the adopted Plan of Conservation and Development (2016 PoCD Southington and 2015 PoCD Bristol). The study team developed concepts that focus on enhancing various land use along the three segments within the corridor. It's important to recognize that this analysis is hypothetical and illustrates a full build-out condition for the long-term scenario. The likelihood of development of all 23 sites and over 500 acres is slim with the trend for redevelopment and the competitive and slow growing economy. However, the purpose of this illustration is to show the benefits of the Preferred Land Use Scenario. The potential developments are identified in [Table 18](#) and [Figure 33](#), below, and described in the following sections.

Table 18: Build Scenario Developments

Site	Type of Development	Segment	Total AM (In/Out)	Total PM (In/Out)	Total Sat MD (In/Out)
1	Residential (Single family)	Northern	2 (1,1)	2 (1,1)	2 (1,1)
2	Residential (Single family)	Northern	3 (1,1)	2 (1,1)	2 (1,1)
3	Residential (Multi-family)	Northern	8 (2,6)	12 (7,4)	10 (5,5)
4	Residential (Single family)	Northern	34 (8,26)	43 (27,16)	42 (23,19)
5	Residential (Multi-family)	Northern	8 (2,6)	12 (7,4)	10 (5,5)
6	Industrial Park / Warehousing	Central	2 (1,1)	2 (1,1)	5 (3,2)
7	Commercial - Self storage	Central	7 (4,3)	10 (5,5)	22 (13,9)
8	Industrial Park / Warehousing	Central	47 (36,11)	49 (13,36)	90 (57,32)
9	Industrial Park / Warehousing	Central	53 (41,12)	55 (15,40)	115 (73,41)
10	Residential (Multi-family)	Central	8 (2,6)	12 (7,4)	10 (5,5)
11	Industrial / manufacturing /distribution center	Central	45 (34,10)	48 (15,33)	0 (0,0)
12	Industrial /manufacturing /distribution center	Central	100 (77,23)	108 (33,74)	0 (0,0)
13	Industrial / manufacturing / distribution center	Southern	24 (18,5)	25 (8,18)	0 (0,0)
14	Convenience/gas station	Southern	228 (116,112)	265 (135,130)	366 (187,179)

Site	Type of Development	Segment	Total AM (In/Out)	Total PM (In/Out)	Total Sat MD (In/Out)
15	Mix use (commercial / residential multi-family)	Southern	892 (402,477)	1206 (672,534)	1775 (935,840)
16	Industrial / manufacturing / distribution center	Southern	15 (11,3)	16 (5,11)	0 (0,0)
17	Sports complex	Southern	127 (84,43)	144 (68,77)	54 (29,25)
18	Mix use (commercial/ residential multi-family)	Southern	322 (79,243)	363 (224,138)	737 (403,334)
19	Residential (Multi-family)	Southern	228 (53,176)	256 (161,95)	528 (285,243)
20	Mix use (commercial / residential / hotel)	Southern	70 (41,29)	86 (44,42)	159 (89,70)
21	Commercial - office space	Southern	42 (37,5)	31 (2,29)	406 (300,106)
22	Retail	Southern	160 (99,61)	140 (67,73)	146 (76,70)
23	Retail	Southern	155 (96,59)	68 (33,35)	67 (35,32)
	Total Northern		56 (13,41)	70 (44,26)	66 (36,30)
	Total Central		261 (195,66)	285 (90,195)	242 (152,89)
	Total Southern		2262 (1036,1213)	2601 (1420,1181)	4238 (2340,1898)
	TOTAL		2579 (1244,1320)	2956 (1554,1403)	4546 (2528,2018)



Source Information

- Planning Departments of the City of Bristol and the Town of Southington
 - NVCOG Map and Data Department

Legend Land Use / Zoning	Residential Multi-family	CT Rail
	Residential Single-family	CT Roads
	Agriculture	Corridor
	Business	Boundary
	Community Facility	Water
Industrial	Transpo_ROW	Sites selected for market analysis

N

Figure 33

CT ROUTE 229 CORRIDOR STUDY
 BRISTOL / SOUTHTON

Market Analysis of Selected Sites

Architecture
 Engineering
 Environmental
 Land Surveying

This study focused on review of traffic signal operations and corridor performance under maximum build-out scenarios where all parcels of land are forecasted with a development that suits the corridor land use and zoning. Based on the municipalities' input, several parcels of land were forecasted to have the following trip generation illustrated in [Table 18](#).

Site 1 through Site 5, Site 10, and Site 19 – These developments are located mostly in the northern segment, are single-family housing and multi-family housing (low-rise), is estimated to have 640 units/houses. The proposed developments are projected to generate 292 vehicle trips in the morning peak hour, 338 vehicle trips in the evening peak hour, and 605 vehicle trips on an average Saturday (midday). The Site 19 is in the Southern segment and it includes development along Churchill Street to the west of the corridor.

Site 6 through Site 9 – These development parcels are located in the central segment of the corridor and are anticipated to be industrial /commercial development in the Industrial Park and along the study area. These developments in general represent warehousing and possible self-storage units. The proposed developments are projected to generate 108 vehicle trips in the morning peak hour, 117 vehicle trips in the evening peak hour, and 232 vehicle trips on the average Saturday (midday).

Site 11 through Site 13, and Site 16 – These development parcels are located in the central segment of the corridor and are anticipated to be industrial developments such as manufacturing in the Industrial Park and along the study area corridor. The proposed developments are projected to generate 183 vehicle trips in the morning peak hour, 198 vehicle trips in the evening peak hour, and zero trips on an average Saturday (midday).

Site 15 and Site 18 - These two proposed developments are located in the southern segment of the corridor study and represent mixed-use development. These two locations represent over 100 acres of land that can be developed into multi-use purposes such as: residential with commercial / retail / food services, medical center with elderly housing and light retail / restaurants or shared office space at lower floor and residential units or hotel services on upper floors. It is estimated that these two locations will generate almost half of all new traffic with 1,214 vehicle trips during the morning peak hour 1,568 vehicle trips in the evening peak hour, and 2,512 vehicle trips on an average Saturday (midday).

Site 22 and Site 23 - These two proposed developments are located in the southern segment of the corridor study and represent large retail development. The proposed developments are projected to generate 315 vehicle trips in the morning peak hour, 208 vehicle trips in the evening peak hour, and 215 vehicle trips on an average Saturday (midday).

Remaining Sites (17, 20-21) - The remaining Sites are all located in the Southington along the southern segment of the corridor. These three locations represent the following respective land uses convenience / gas station, hotel, and office park. The proposed developments are projected to generate 466 vehicle trips in the morning peak hour, 527

vehicle trips in the evening peak hour, and 985 vehicle trips on an average Saturday (midday).

Comparing the 2021 Existing Traffic Volumes to the projected 2040 Future Traffic Volumes reveals that there is a potential for significant overall traffic volume growth as a result of future development surrounding the corridor within the 20-year study horizon. The projected traffic growth within the study corridor ranges from 25% to 60%, equating to more than a 40% average annual growth in some areas across the three segments.

Trip Distribution

The directional distribution of traffic is typically a function of population densities, competing shopping opportunities, existing travel patterns adjacent to the Site, and the efficiency and limitations of the existing roadway system. The anticipated traffic volumes generated by the proposed development were projected based upon guidelines set forth by CTDOT and data provided by the ITE Trip Generation Manual 10th Edition. This widely used reference manual provided trip generation rates for various land uses based on traffic count data collected at similar sites. The land uses that were analyzed for the 20-year build-outs are outlined below along with their ITE descriptions and land use code (LUC) as follows:

- General Light Industrial (LUC 110) – A light industrial facility is a free-standing facility devoted to a single-use. The facility has an emphasis on activities other than manufacturing and typically has minimal office space. Typical light industrial activities include printing, material testing, and assembly of data processing equipment.
- Industrial Park High-Cube Transload (LUC 130) - An industrial park contains a number of industrial or related facilities. It is characterized by a mix of manufacturing, service and warehouse facilities with a wide variation in the proportion of each type of use from one location to another. Many industrial parks contain highly diversified facilities – some with a large number of small businesses and others with one or two dominant industries.
- Manufacturing (LUC 140) - A manufacturing facility is an area where the primary activity is the conversion of raw materials or parts into finished products. Size and type of activity may vary substantially from one facility to another. In addition to the actual production of goods, manufacturing facilities generally also have an office, warehouse, research, and associated functions.
- Multi-family Housing (Low-Rise) (LUC 220) - Low-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have one or two levels (floors).
- Mid-Rise Residential with 1st-Floor Commercial (LUC 231) - Mid-Rise residential with 1st-floor commercial are mixed-use multi-family housing buildings that have between three and ten levels (floors) and include retail space on the first level.
- Hotel (LUC 310)- A hotel is a place of lodging that provides sleeping accommodations and supporting facilities such as restaurants, cocktail lounges,

meeting and banquet rooms or convention facilities, limited recreational facilities (pool, fitness room), and / or other retail and service shops.

- All Suites Hotel (LUC 311) - All Suites Hotel is a place of lodging that provides sleeping accommodations, a small restaurant and lounge, and small amounts of meeting space. Each suite includes a sitting room and a separate bedroom. Limited kitchen facilities are provided within the suite.
- Youth Sports Complex (Soccer Complex) (LUC 488) - Due to the unique nature of "Youth Sports Complex", and lack of any empirical data for a specific mixed sports complex, comparable data for a soccer complex was used. A soccer complex is an outdoor facility that is used for non-professional soccer games. It may consist of multiple fields. The size of each field within the land use may vary to accommodate games for different age groups. Ancillary amenities may include stadium seating, a fitness trail, an activities shelter, an aquatic center, picnic grounds, basketball and tennis courts, and a playground.
- General Office Building (LUC 710) - A general office building houses multiple tenants; it is a location where affairs of businesses, commercial or industrial organizations, or professional personas or firms are conducted. An office building or buildings may contain a mixture of tenants including professional services, insurance companies, investment brokers, and tenant services, such as a bank or savings and loan institution, a restaurant, or cafeteria and service retail facilities. A general office building with a gross floor area of 5,000 square feet or less is classified as a small office building.
- Variety Store (LUC 814) - A variety store is a retail store that sells a broad range of inexpensive items often at a single price. These stores are typically referred to as "dollar stores." Items sold at these stores typically include kitchen supplies, cleaning products, home office supplies, food products, household goods, decorations, and toys. These stores are sometimes stand-alone sites, but they may also be located in small strip shopping centers.
- Commercial Shopping Center (LUC 820) - A shopping center is an integrated group of commercial establishments that is planned, developed, owned, and managed as a unit. A shopping center's composition is related to its market area in terms of size, location, and type of store. A shopping center also provides on-site parking facilities sufficient to serve its own parking demands.
- High-Cube Warehouse (HCW) - A building that typically has at least 200,000 gross square feet of floor area, has a ceiling height of 24 feet or more, and is used primarily for the storage and/or consolidation of manufactured goods (and to a lesser extent raw materials) prior to their distribution to retail locations for other warehouses. A typical HCW has a high level of on-site automation and logistics management. The automation and logistics enable the highly efficient processing of goods through the HCW.
- High-Cube Transload and Short-Term Storage Warehouse (LUC 154) - The HCWs included in this land use include transload and short-term facilities. Transload facilities have a primary function of consolidation and distribution of pallet loads (or larger)

for manufacturers, wholesalers, or retailers. They typically have little storage duration, high throughput, and are high-efficiency facilities. Short-term HCWs are high-efficiency distribution facilities often with custom / special features built into structure for movement of large volumes of freight with only short-term storage of products.

- High-Cube Cold Storage Warehouse (LUC 157) - High-cube cold storage warehouses are facilities typified by temperature-controlled environments for frozen food or other perishable products.
- Warehousing (LUC 150) - A warehouse is primarily devoted to the storage of materials, but it may also include office and maintenance areas.
- Office Park (LUC 750) - An office park is usually a suburban subdivision or planned unit development containing general office buildings and support services, such as banks, restaurants, and service stations, arranged in a park- or campus-like atmosphere.
- Research Park (LUC 770) - A business park consists of a group of flex-type or incubator one- or two-story buildings served by a common roadway system. The tenant space is flexible and lends itself to a variety of uses. The rear side of the building is usually served by a garage door. Tenants may be start-up companies or small mature companies that require a variety of space. The space may include offices, retail and wholesale stores, restaurants, recreational areas and warehousing, manufacturing, light industrial or scientific research functions. The average mix is 20 to 30 percent office / commercial and 70 to 80 percent industrial / warehousing.
- Mixed-Use Developments (LUC – varies) – A mixed-use development comprises two or more different land uses on the same property or proposed in the same development.

The directional distribution of traffic was estimated primarily on adjacent roadway volumes for each of the proposed developments using Trafficware's Synchro plus SimTraffic 11 – Traffic Signal Coordination Software, based on the 2010 Highway Capacity Manual (HCM) methodology. The distribution of the anticipated traffic volumes was based on arrival / departure patterns shown in the [Appendix H](#) for each of the developments. Several of the proposed developments could benefit from pass-by trips and internal capture. Pass-by traffic consists of vehicles already on the roadway that are attracted to the Site when passing through the area. The primary destination of this traffic is elsewhere, and the primary trip will be resumed following a stop at the proposed commercial / retail development. Pass-by trip reduction applies only to commercial / retail developments. The ITE Trip Generation Manual 10th Edition provides percent ranges for pass-by component for retail and commercial developments based on size and type of services provided. The Connecticut Department of Transportation (CTDOT) provides additional guidelines which allow 20% pass-by component for retail for example. An internal trip, as defined by the ITE Manual, is one that is made without utilizing the major road system and also include trips within a highly interactive area containing complementary land uses and convenient internal on or off-street connections that may use short segments of major streets. Internal trips are mostly generated in mixed-use development, where both the origin and destination are within the development.

For site impact analysis purposes, an internal capture rate that is set too low may unfairly penalize developers by making them pay more than their fair share of costs for transportation mitigation measures. Conversely, an internal capture rate that is set too high may unfairly place this burden on the public. Both cases may result in sub-optimal build-out, particularly in urban areas. The CTDOT guide allows 5% internal capture reduction. Overall, a 25% reduction factor was used across all trips generated by the proposed developments. The reduction will account for pass-by, internal capture, and travel mode change from single-occupancy vehicle (SOV).

The study results have indicated that the twenty-three sites will generate 4,546 trips during an average weekday, where the proposed developments are projected to generate 2,579 vehicle trips in the morning peak hour, 2,956 vehicle trips in the evening peak hour, and 4,546 vehicle trips on an average Saturday (midday). With the reduced number of trips, the average weekday morning generates 1,934 additional trips, the average weekday evening generates 2,217 trips, and the average Saturday midday generates 3,410 trips.

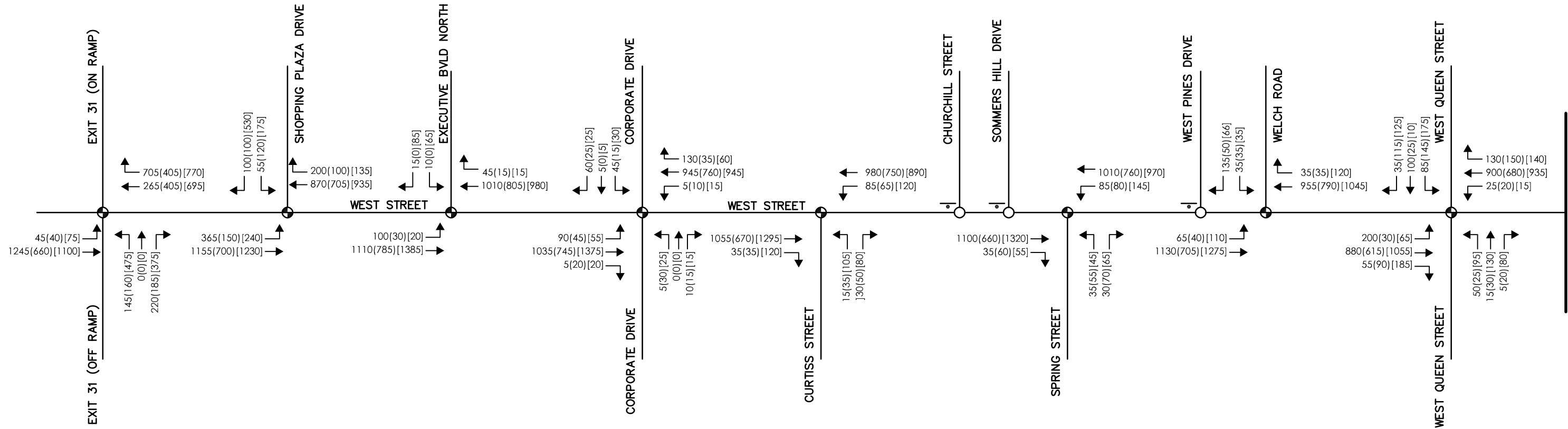
Future Traffic Operations

The future conditions analysis includes traffic projections based on the methodology described in the previous section to expand the 2021 Existing Traffic volumes to the 2040 Future Traffic volumes.

Figure 34.1 through **Figure 34.4** illustrates the Base volumes for 2040, while **Figure 35.1** through **Figure 35.4** present visual representations of 2040 Future Build conditions. **Figure 9** through **Figure 11** present the overall intersection LOS results on a study area map with LOS color coded by letter while **Table 19** summarizes the morning and afternoon peak hour analyses results for the area intersections in terms of LOS and average delay. Contained in the **Appendix I**, the capacity analysis reports are included for the morning and afternoon peak hours, respectively.

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- STOP CONTROL APPROACH
- WEEKDAY AM: XXX
- WEEKDAY MID-DAY: (XXX)
- WEEKDAY PM: [XXX]



MATCHLINE - A

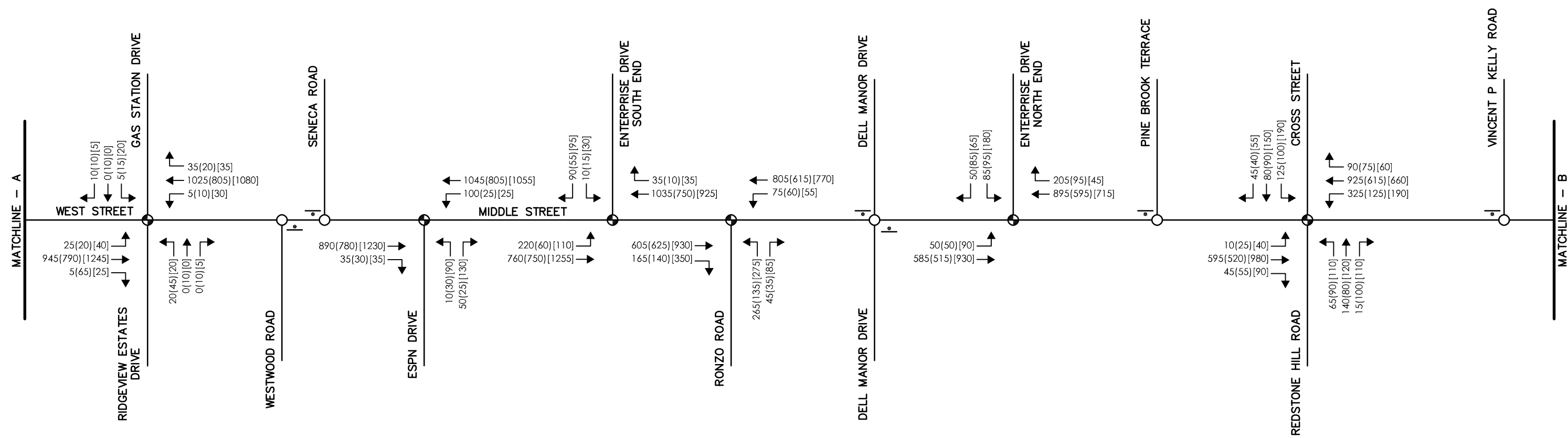
NO BUILD (2041) TRAFFIC VOLUMES
CT ROUTE 229 CORRIDOR STUDY
NAUGATUCK VALLEY COUNCIL OF GOVERNMENTS

Figure 34.1



LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- STOP CONTROL APPROACH
- WEEKDAY AM: XXX
- WEEKDAY MID-DAY: (XXX)
- WEEKDAY PM: [XXX]



5/12/2022, PPADLO, G:\JOBS\19\18\1901992\DWG\TLO\190199201.DWG, FIG.4.2.



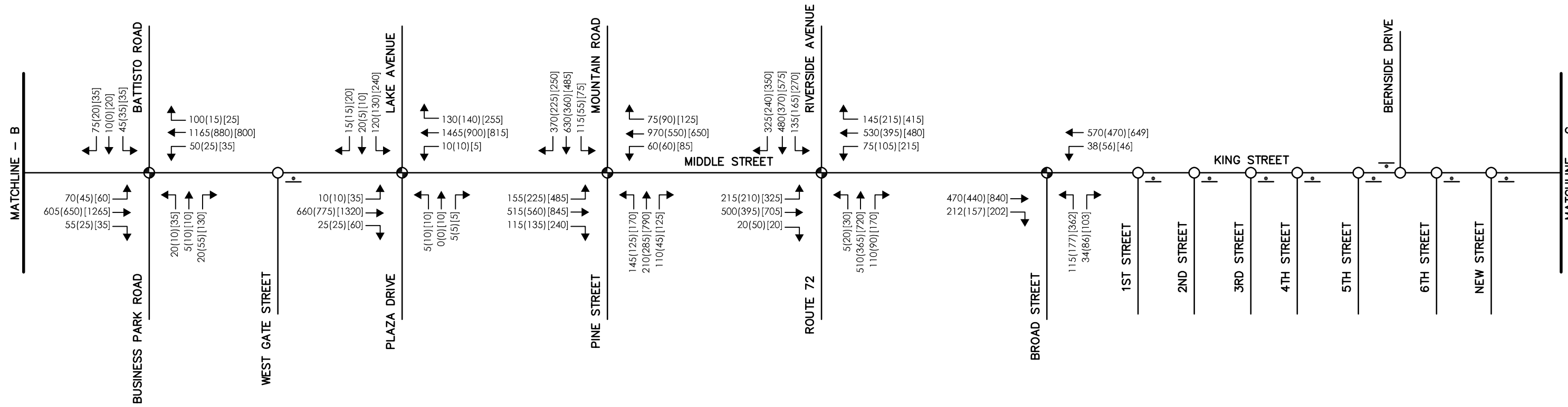
ARCHITECTURE
ENGINEERING
ENVIRONMENTAL
LAND SURVEYING

NO BUILD (2041) TRAFFIC VOLUMES
CT ROUTE 229 CORRIDOR STUDY
NAUGATUCK VALLEY COUNCIL OF GOVERNMENTS

Figure 34.2

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- STOP CONTROL APPROACH
- WEEKDAY AM: XXX
- WEEKDAY MID-DAY: (XXX)
- WEEKDAY PM: [XXX]



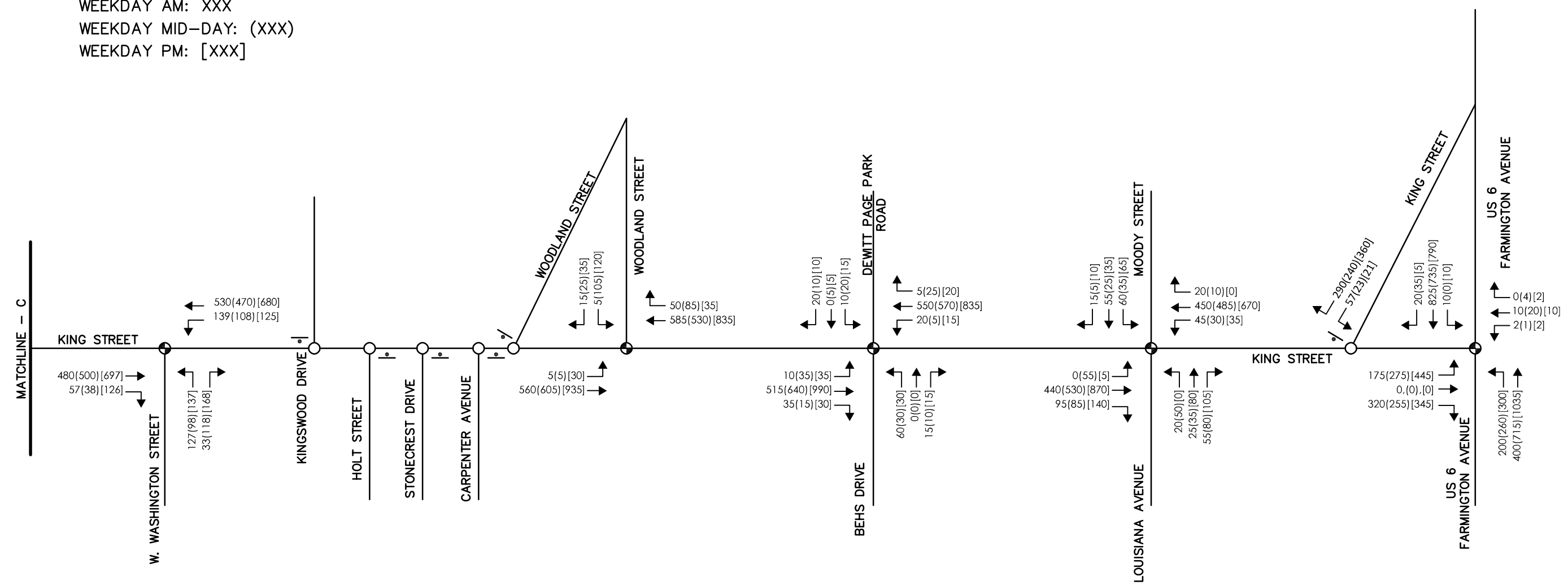
NO BUILD (2041) TRAFFIC VOLUMES
CT ROUTE 229 CORRIDOR STUDY
NAUGATUCK VALLEY COUNCIL OF GOVERNMENTS

Figure 34.3



LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- STOP CONTROL APPROACH
- WEEKDAY AM: XXX
- WEEKDAY MID-DAY: (XXX)
- WEEKDAY PM: [XXX]



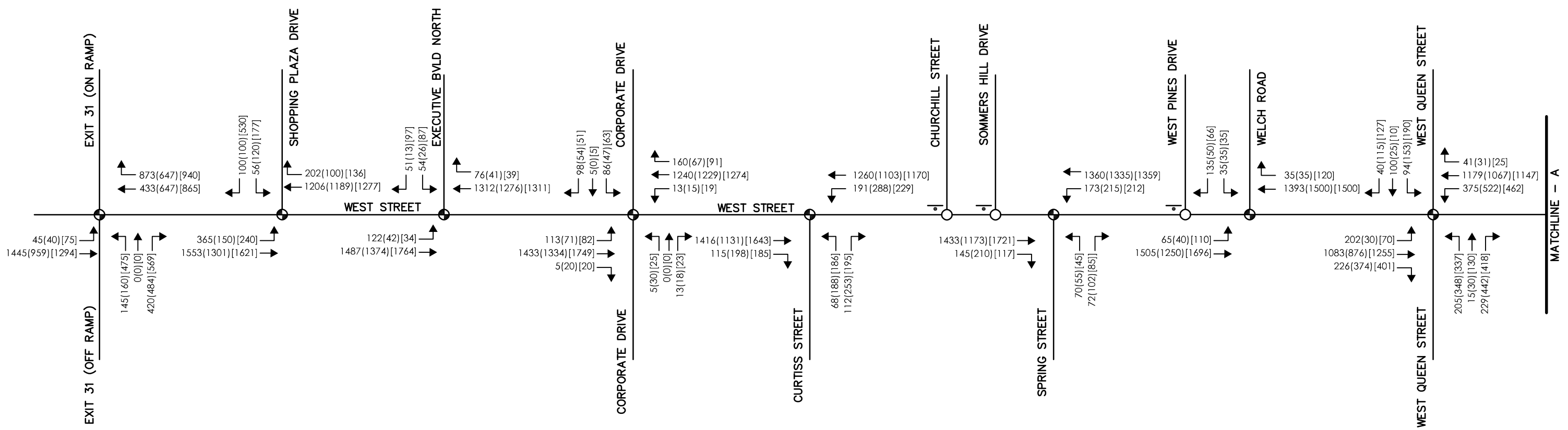
NO BUILD (2041) TRAFFIC VOLUMES
CT ROUTE 229 CORRIDOR STUDY
NAUGATUCK VALLEY COUNCIL OF GOVERNMENTS

Figure 34.4



LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- STOP CONTROL APPROACH
- WEEKDAY AM: XXX
- WEEKDAY MID-DAY: (XXX)
- WEEKDAY PM: [XXX]



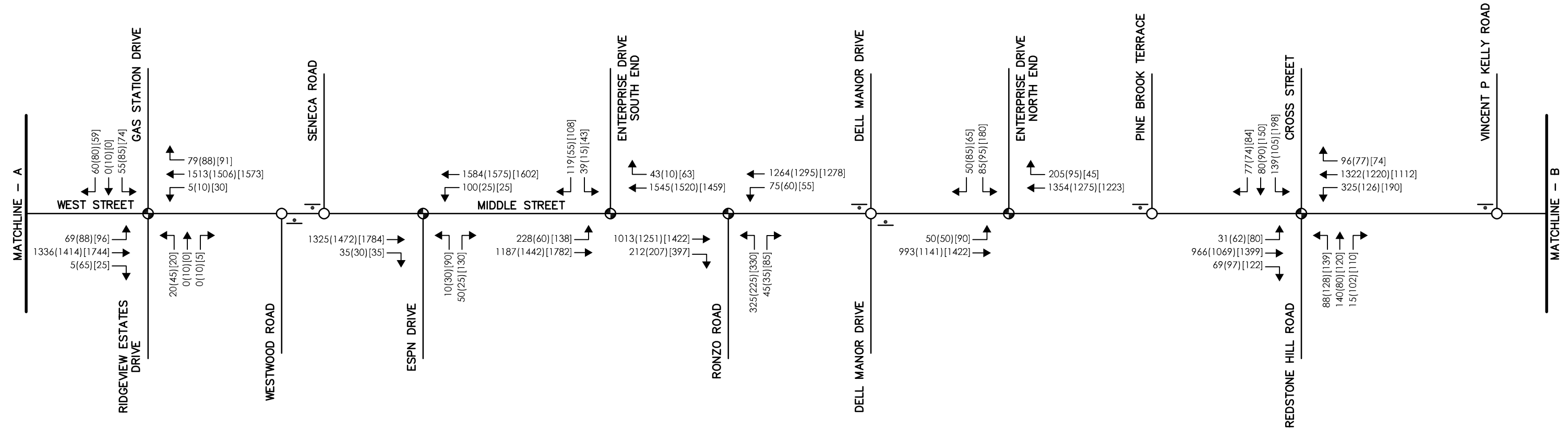
BUILD (2041) TRAFFIC VOLUMES
CT ROUTE 229 CORRIDOR STUDY
NAUGATUCK VALLEY COUNCIL OF GOVERNMENTS

Figure 35.1



LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- STOP CONTROL APPROACH
- WEEKDAY AM: XXX
- WEEKDAY MID-DAY: (XXX)
- WEEKDAY PM: [XXX]



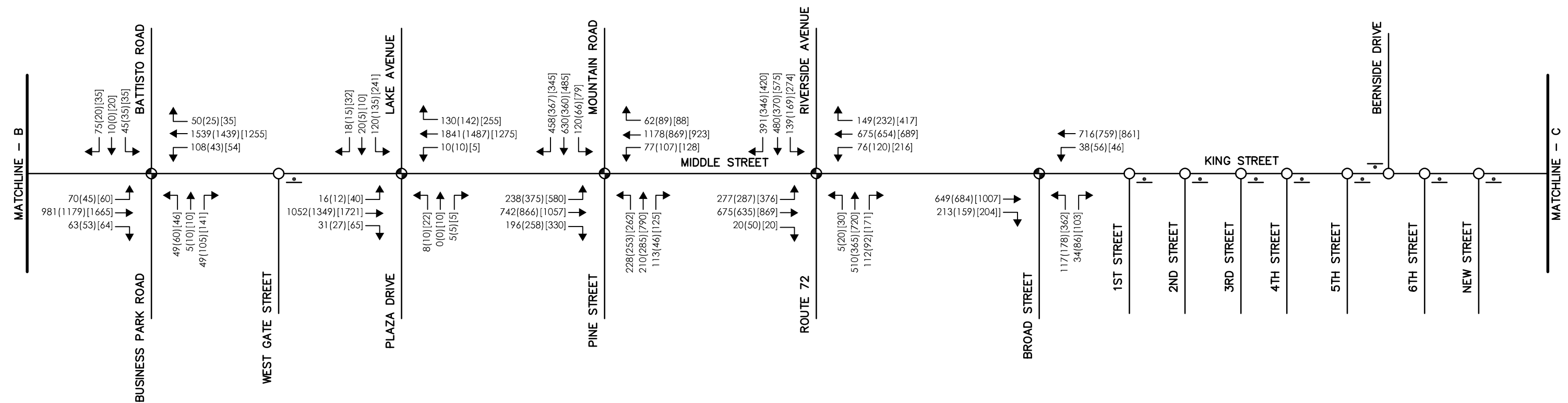
BUILD (2041) TRAFFIC VOLUMES
CT ROUTE 229 CORRIDOR STUDY
NAUGATUCK VALLEY COUNCIL OF GOVERNMENTS

Figure 35.2



LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- STOP CONTROL APPROACH
- WEEKDAY AM: XXX
- WEEKDAY MID-DAY: (XXX)
- WEEKDAY PM: [XXX]



5/12/2022, PPADLO, G:\JOBS\19\18\1901992\DWG\TFO\190199201.DWG, FIG.5.3.



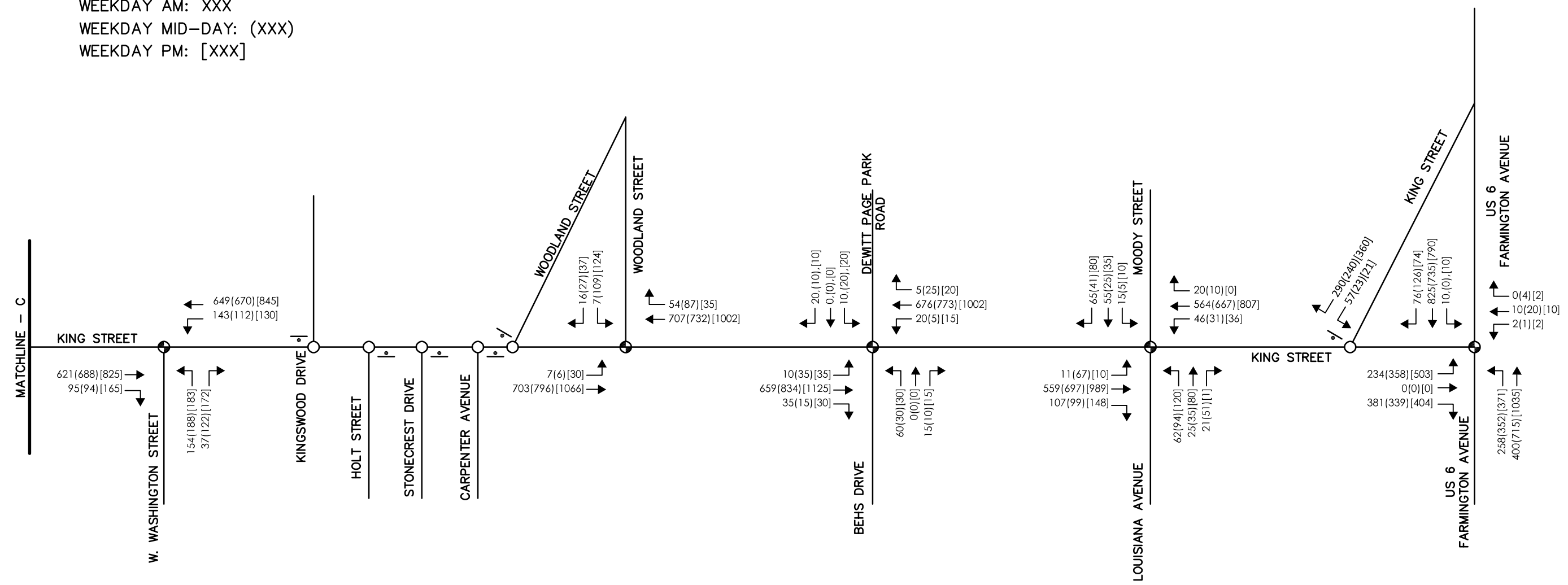
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LAND SURVEYING

BUILD (2041) TRAFFIC VOLUMES
CT ROUTE 229 CORRIDOR STUDY
NAUGATUCK VALLEY COUNCIL OF GOVERNMENTS

Figure 35.3

LEGEND

- SIGNALIZED INTERSECTION
- UNSIGNALIZED INTERSECTION
- STOP CONTROL APPROACH
- WEEKDAY AM: XXX
- WEEKDAY MID-DAY: (XXX)
- WEEKDAY PM: [XXX]



BUILD (2041) TRAFFIC VOLUMES
CT ROUTE 229 CORRIDOR STUDY
NAUGATUCK VALLEY COUNCIL OF GOVERNMENTS

Figure 35.4



Table 19: 2040 Build Scenario: Signalized Intersection – Level of Service

	Intersections with RT-229	2040 Build Conditions Level of Service / Delay (seconds)		
		AM	MD	PM
King Street Northern Segment	at Farmington Avenue / US6	B/16.0	C/22.7	D/41.1
	at Moody Street / Louisiana Avenue	B/10.2	B/10.8	C/22.1
	at Page Park Road / High School	A/5.5	A/5.7	A/7.5
	at Woodland Street	A/3.5	B/10.7	C/29.7
	at West Washington Street	C/24.5	C/31.6	E/70.7
	at Broad Street	A/9.5	A/9.2	B/18.9
Middle Street Central Segment	at Riverside Avenue / Relocated Route 72	D/42.5	C/31.8	D/48.4
	at Mountain Road/ Pine St	D/53.1	E/69.8	D/48.6
	at Lake Avenue / Terry Commons Driveway	B/13.4	B/15.2	B/16.3
	at Battista Road / Business Park Drive	B/19.1	C/25.0	C/20.3
	at Cross Street / Redstone Hill Road	C/34.1	D/47.9	C/33.8
	at Enterprise Drive North	A/5.3	A/7.5	C/27.3
	at Driveway / Ronzo Road	B/15.6	D/41.1	C/30.5
	at Enterprise Drive South	C/25.2	A/7.4	B/13.1
	at ESPN Drive	B/11.4	C/28.7	B/11.7
West Street Southern Segment	at Private Drive/ Ridgeview Estates	B/10.2	B/13.9	B/13.7
	at West Queen Street	D/38.4	F/99.1	F/139.0
	at Welch Road	B/14.9	C/23.7	C/22.8
	at Spring Street	B/17.7	B/14.2	C/20.4
	at Curtiss Street	D/38.9	D/40.9	B/14.0
	at Corporate Drive / Centrion Plaza Drive	D/45.5	A/5.0	B/11.7
	at Executive Boulevard North	A/8.9	A/8.4	B/12.6
	at Executive Boulevard South	A/9.6	A/10.0	B/15.1
	at I-84 WB On Ramp / I-84 WB Off Ramp	C/32.6	C/22.2	C/27.6

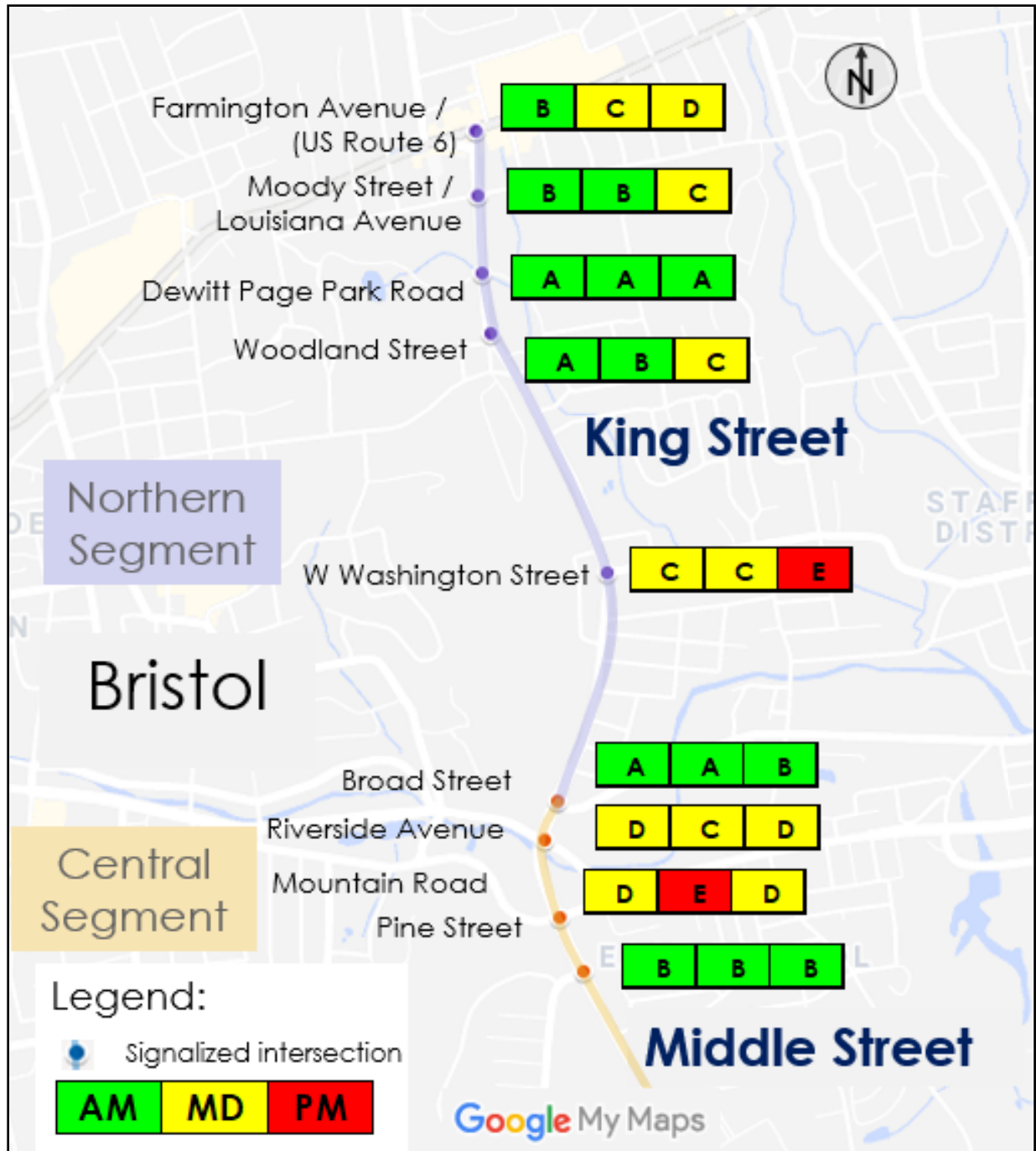


Figure 36 Service (LOS) for Northern Section of Study Intersection

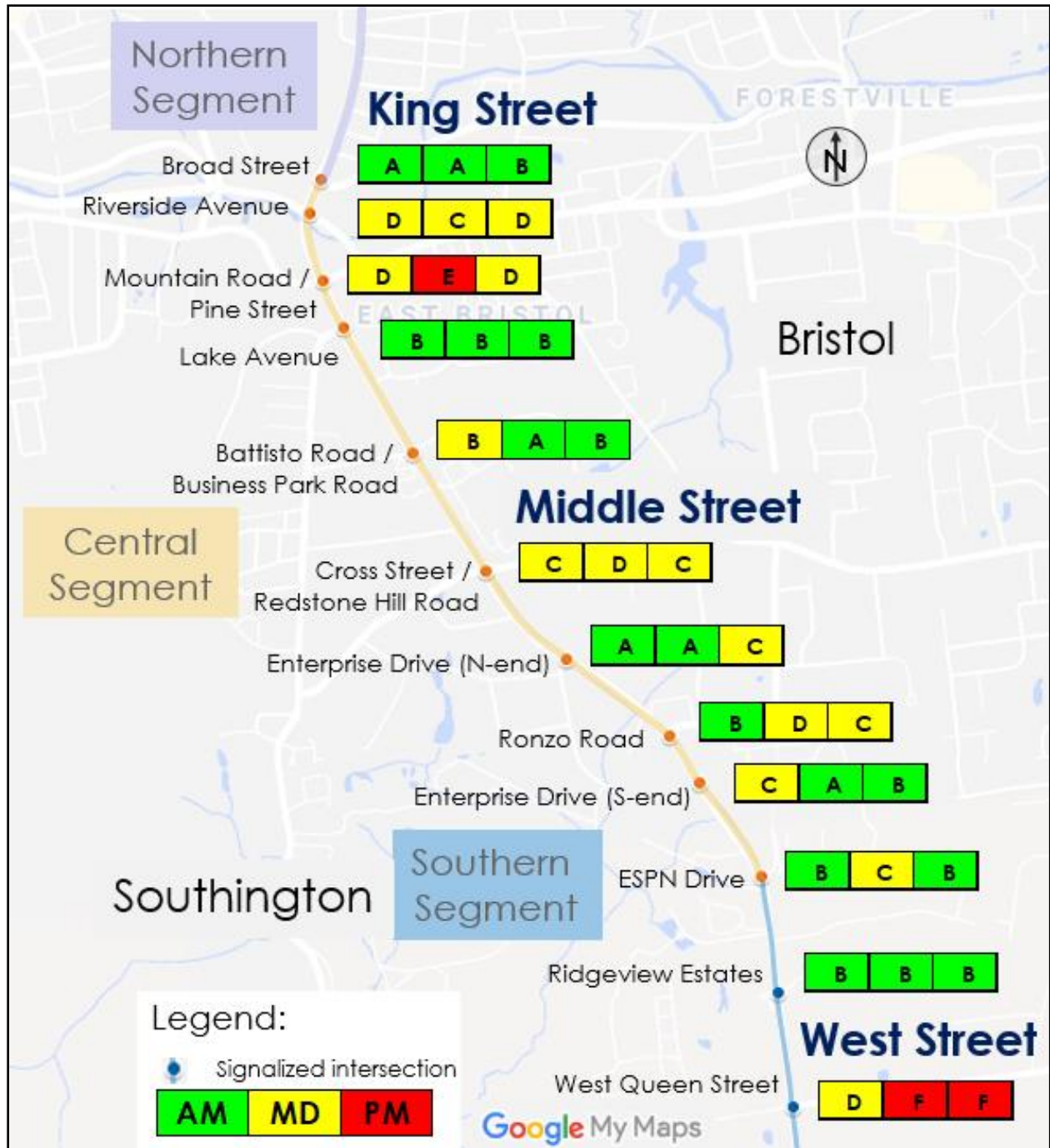


Figure 37 Service (LOS) for Central Section of Study Intersection

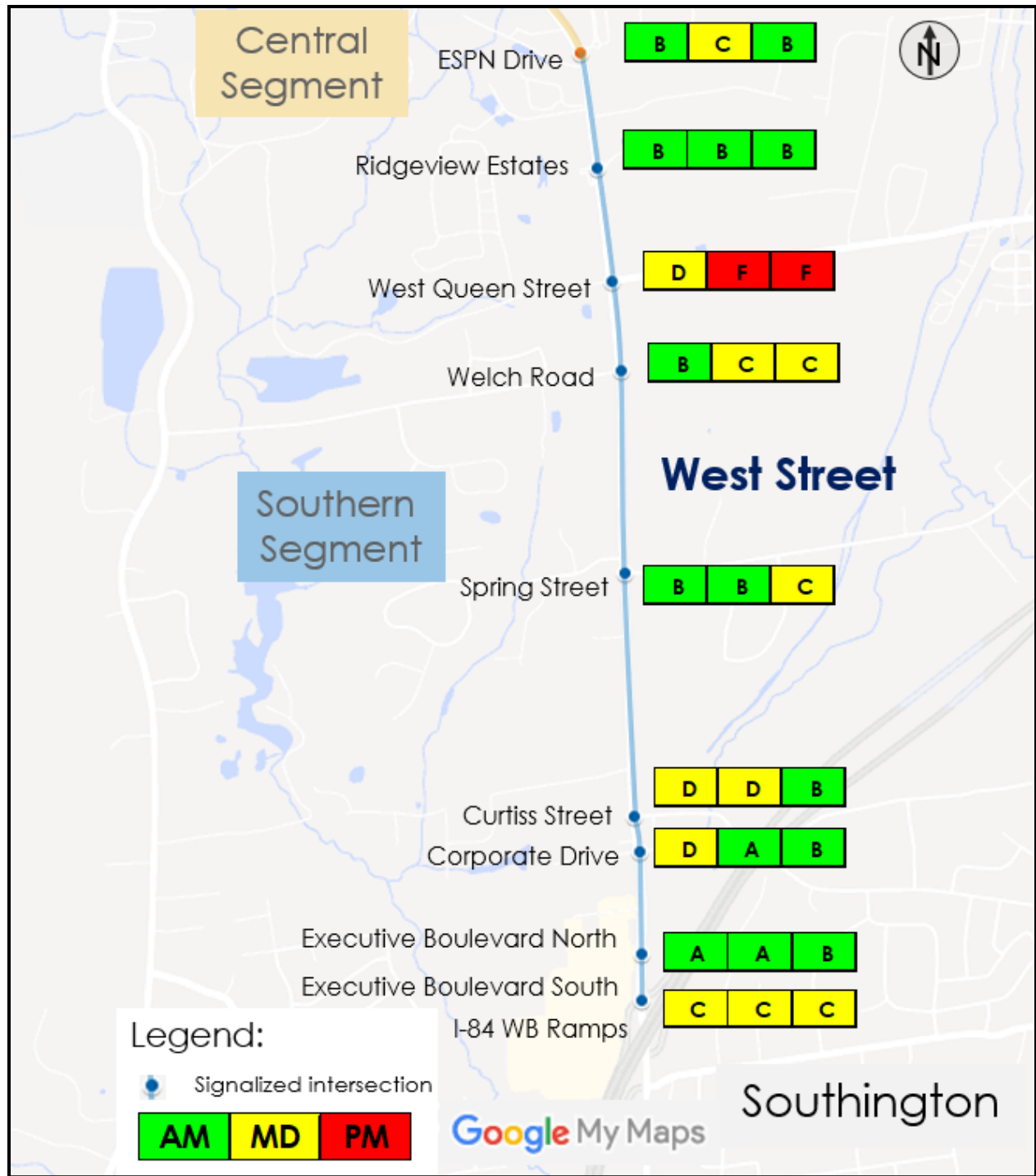


Figure 38 Service (LOS) for Southern Section of Study Intersection

The 2040 Future-Optimized analysis utilizes existing geometry but modifies intersection signal operations to provide the most efficient operations based on future traffic with adjustments to traffic control signal timings and settings. This optimization analysis determines if future needs can be mitigated through low-cost adjustments to signal operations or if additional physical improvements are needed to provide measurable impacts. The future conditions analyses provide the basis for generating roadway improvement plans for the study area to accommodate anticipated traffic growth and development around the corridor.

This report concludes with future areas of concern based upon the results of the traffic analyses. These areas are the focus of on-going planning and traffic analyses with the goal of generating a set of physical improvements to accommodate projected travel demand, in addition to addressing the safety concerns, multi-modal accessibility, and other operational goals in the CT Route 229 study area.

Areas of Concern

As identified in the traffic analyses, the poor traffic operations that were identified under the Assessment of Existing Conditions become significantly worse under future travel demand and some intersections that exhibited acceptable operations begin to degrade under future travel demand. The areas outlined below will be the focus of efforts to plan roadway improvements to mitigate the impact of projected travel demand on the corridor. Other improvements to address the overall study goals and objectives will also be reviewed under future study tasks.

Multimodal Amenities

The 2040 Future-Optimized analysis utilizes existing geometry but modifies intersection signal operations to provide the most efficient operations based on future traffic with adjustments to traffic control signal timings and settings. This is not sufficient to accommodate the growing demand in the corridor and increasing delay. A functioning multimodal corridor could alleviate some of the congestion by moving the single occupancy vehicle drivers into other modes such as transit, walking, and biking that utilize less roadway space and improve corridor performance.

High Crash Rate Areas

The Connecticut Crash Data Repository statistics helped to identify several key locations with safety concerns and prioritize these locations on CT Route 229 for improvement. Several of these locations coincide with highly congested areas and locations identified by the public as areas of concern. These locations include:

- King Street at Moody Street / Louisiana Avenue
- Middle Street at Riverside Avenue / Relocated CT Route 72 (Trident Area)
- Middle Street at Mountain Road / Pine Street
- West Street at West Queen Street
- West Street at Curtiss Street

Bristol Eastern High School Area – King St at Page Park @ Bristol Eastern High School

- The intersection experiences poor operations at LOS E/F during morning and afternoon peak hours.
- High frequency of intersection collisions, including significant turning movement and sideswipe collisions, due to the volume of turning traffic and lack of a CT Route 229 SB left turn lane.
- Limited pedestrian accommodations at a high pedestrian location due to the adjacent park and high school.
- The existing cross-walk, pedestrian ramps, and signal are not compliant with ADA requirements
- There is insufficient and poorly located signage or identification of school zone to warn the vehicular traffic of high pedestrian volume

Trident Area – Middle Street / Route 72 / Mountain Rd / Riverside Avenue

- The location that includes three intersections, experiences poor operations at LOS E/F during all peak hours during no build conditions.
- High frequency of intersection collisions including significant turning movement and sideswipe collisions due to the volume of turning traffic.
- Transit stops on Pine Road between Route 72 extension and Mountain Road just to the west of CT Route 229 intersection should be evaluated for safety and relocated as necessary with the appropriate amenities.

Vincent P Kelly Road at Middle Street Intersection

- This is one of the three unsignalized intersections that was requested by city officials and the public for signal installation and operation. This location is community sensitive as it services several of the City of Bristol departments including Bristol Fire Engine No.4.

Curtis Street at West Street Intersection and Churchill Street at West Street Intersection

- The intersection with Curtiss Street experiences high volumes during PM Peak Period in Existing, No Build and Build condition.
- The intersection with Churchill Street is unsignalized and has lower volumes, however there is a high frequency of crashes including rear-end or angle crashes. These conditions exacerbated by grade on West Street and on Churchill Street, thus limiting sight lines.
- From Churchill Street intersection to the north, there are no sidewalks or multi-modal accommodations along the CT Route 229 corridor.

West Pines Drive at West Street Intersection and Spring Street at West Street Intersection

- Spring Street and West Pines Drive intersections are separated by approximately 150' essentially creating an offset intersection.
- The Spring Street intersection is signalized and experiences high volumes during PM Peak Period during Existing, No Build and Build condition.
- The proximity of the two intersections creates additional friction between the two intersections' operations. A high frequency of crashes including significant angle and rear-end collisions further illustrate the issue.
- The West Pines Drive intersection will require analysis as a signalized T-intersection or as a 4-leg intersection with Spring Street.
- There are no sidewalks or multi-mode facilities provided along the CT Route 229 environment in this area.

Southern Segment: Continuous Southbound Two Through Lanes

- The location stretches south from the ESPN Intersection to the intersection with Executive Blvd North. An additional lane would improve the southbound through movement and overall intersection performance. The analysis will include changes to signal timings to accommodate shared left/ shared right lane where limited by the Right of Way.

Alternative Analysis

The following sections present the improvement alternatives for the areas of concern in the study area. The sections include a description of the improvement concepts, as well as a summary of the expected traffic operations following implementation of the improvements when compared to the future no-build condition. It is worth noting that certain needs and deficiencies will be addressed with one improvement concept without the need to review multiple solutions to identify the preferred approach. These single stand-alone improvements become the primary study recommendations. To test the magnitude of the improvements necessary for better traffic operations of CT Route 229 corridor intersections, a microsimulation network was generated. The microsimulation utilizes the forecasted volumes and proposed roadway changes to test immensity of improvements.

Recommendations

This section details the potential transportation system improvements and enhancements for the study area. The recommendations address existing deficiencies and future needs resulting from the forecasted travel demand expected in the study area by the year 2040.

The improvements to the transportation system aim to mitigate the effects of future traffic growth, improve safety, increase multi-modal accessibility, and promote alternative modes of travel. Although, many of the individual recommendations address transportation issues related to motor vehicles, a series of alternative mode enhancement recommendations were developed to address pedestrian, cyclist, transit, and commuter facilities usage of the corridor. Additionally, each of the “focus area” improvements were reviewed for alternative travel mode enhancements and, where appropriate, provide improvements to the transportation system for all users

The development and refinement of the improvements were prepared in cooperation with NVCOG and the two municipalities to identify implementable solutions that adequately meet the goals of the study by addressing both the existing deficiencies and potential future operational issues identified and described in the previous sections of the report.

Multimodal Enhancements

Planning for the future of transportation along the CT Route 229 corridor includes recognizing and responding to the need for safer and more convenient accommodations for pedestrians, bicyclists, and transit users. The primary goal of this study is planning for complete streets – or streets that are designed to enable safe and reasonable access for all users – is consistent with CTDOT, NVCOG, CRCOG, Bristol and Southington policies as well as Connecticut State law.

As mentioned in the existing condition report, the Study Area is typical of a low-to-medium density suburban setting. The study corridor lacks a continuous sidewalk. Pedestrians are often forced to walk in the shoulder of the roadway or on lawns. Cyclists ride on the shoulder and on sidewalks as delineated on-street bicycle facilities are not available for their use. The limited bicycle and pedestrian facilities within the Study Area discourage,

rather than encourage, non-motorized travel. Also, there are limited facilities for transit riders. The potential benefits of safer and more accessible multimodal accommodations in the CT Route 229 corridor include:

- Less dependence on single-occupancy motor vehicle use for daily commuting and other trips in the corridor. This helps mitigate traffic growth, preserves the capacity of the existing roadway, and improves air quality by reducing vehicular emissions.
- Greater ability to walk between destinations, particularly within more dense developments through the access management overlay zone and northern segment. This facilitates park-once-and-walk behavior, thereby reducing traffic demand in the corridor and creating shared parking opportunities.
- Healthier lifestyles and better quality-of-life for corridor residents and patrons, particularly when better pedestrian and bicycle facilities are provided within the context of attractive and unique recreational and commercial destinations in the corridor as well as providing better connectivity to the existing network.

This section describes recommendations that will improve the safety, accessibility, and convenience of pedestrian, bicycle, and transit accommodations in the CT Route 229 corridor.

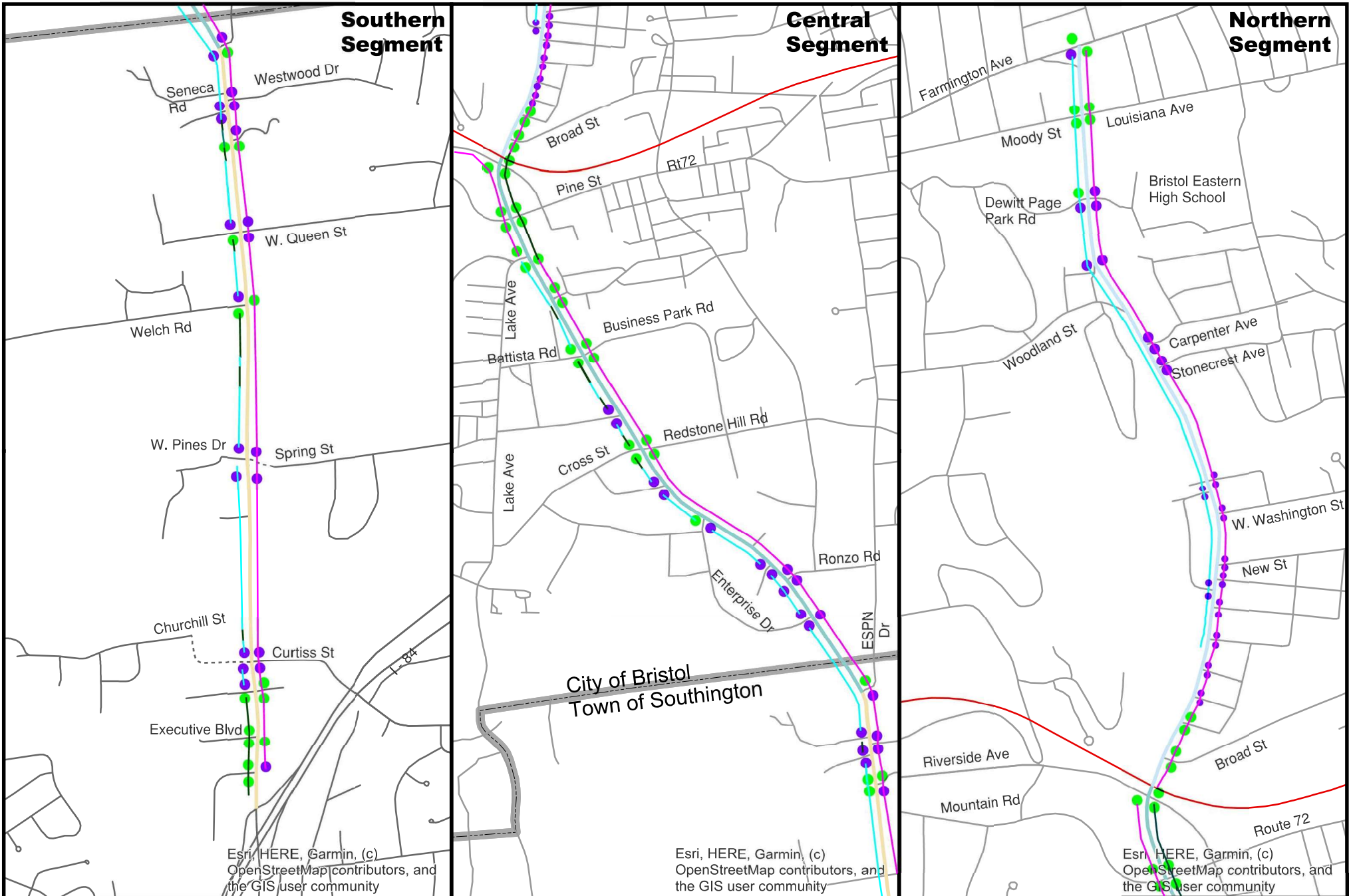
Pedestrian Enhancements

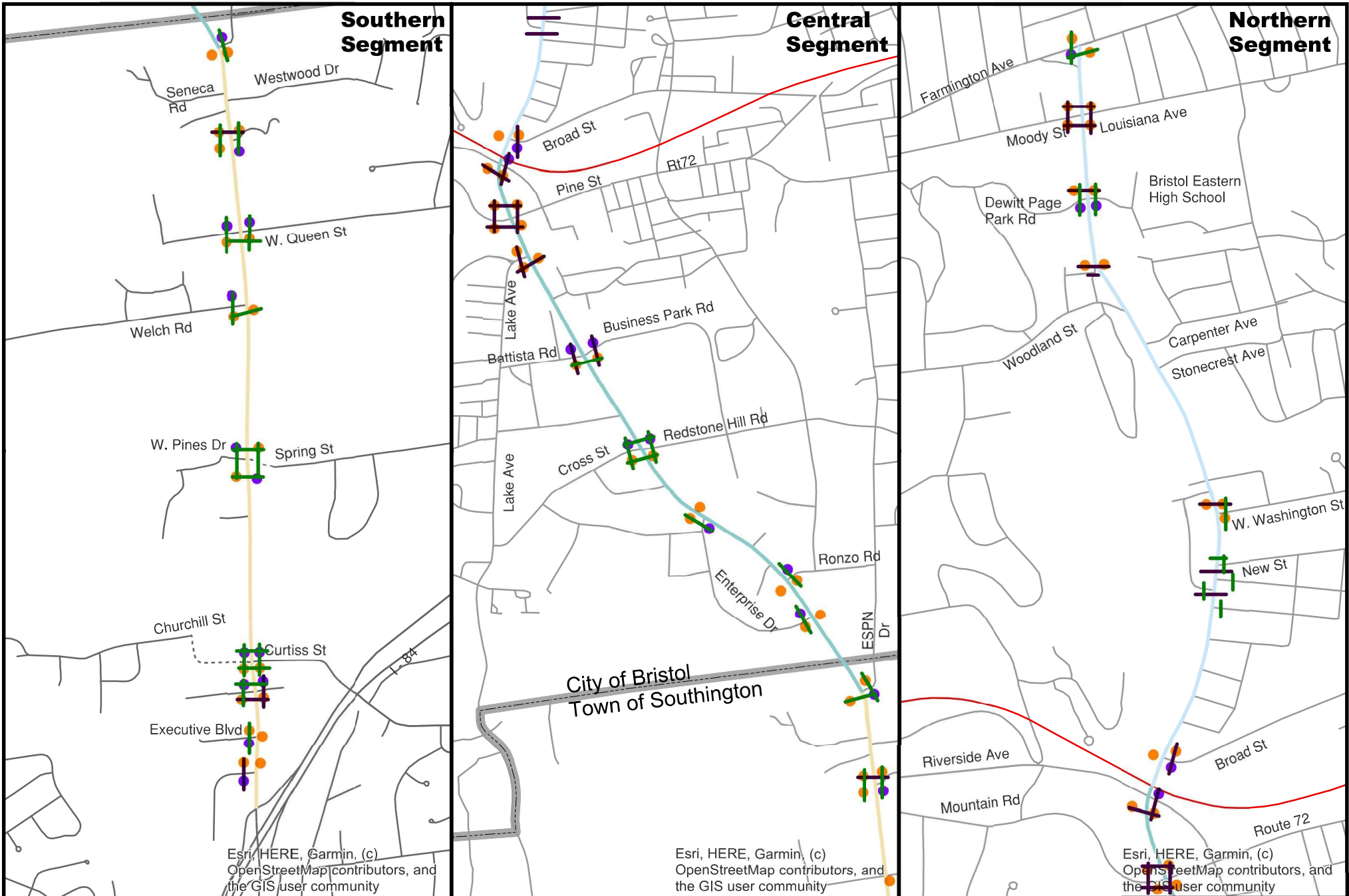
While portions of the corridor are suburban in nature, the study area generally has limited sidewalks in the central and southern segments. Other pedestrian facilities are limited to incomplete sets of pedestrian actuated signals and limited pedestrian push buttons that are not accessible to people with disabilities.

- Sidewalks should be a minimum of 5-feet wide, with a preferred width of 6-feet where space allows. Given the traffic speed and traffic volume on CT Route 229, sidewalks should be offset from the edge of the roadway to the greatest extent possible, preferably 4 feet or more where space allows. This separation removes pedestrians from exposure to large vehicle wind gusts, roadway noise, and water spray from wet pavement. The separation area also provides space for snow storage and landscaping when appropriate.
- New crosswalks will be required as pedestrian infrastructure is expanded in the study area. The recommended locations for new crosswalks, based upon the proposed sidewalk network, include the following locations shown in [Figure 39](#) and [Figure 40](#). The recommended locations for new crosswalks at the intersections, based upon the proposed sidewalk network, include the following locations:
 - CT Route 229/ King Street at US Route 6 /Farmington Avenue (east side, south side)
 - CT Route 229/ King Street at Page Park / Bristol Eastern High School (east side, west side, north side, south side)
 - CT Route 229/ King Street at Carpenter Avenue (east side)
 - CT Route 229/ King Street at Stonecrest Drive (east side)
 - CT Route 229/ King Street at Holt Street (east side)
 - CT Route 229/ King Street at Kingswood Drive (west side)

- CT Route 229/ King Street at West Washington Street (refresh crossing to the north and provide new to the east side)
 - CT Route 229/ King Street at New Street (east side)
 - CT Route 229/ King Street at 6th Street (east side)
 - CT Route 229/ King Street at Bernside Drive (west side)
 - CT Route 229/ King Street at 5th Street (east side)
 - CT Route 229/ King Street at 4th Street (east side)
 - CT Route 229/ King Street at 3rd Street (east side)
 - CT Route 229/ King Street at 2nd Street (east side)
- In addition, mid-block crosswalks are proposed near community facilities such as parks, playgrounds, and school facilities. The proposed midblock crosswalks include:
 - Across King Street at Wilson Park
 - Across King Street at Page Park near the northern edge of the park limits.
- The new crosswalk locations will require the installation of crosswalk pavement markings, ADA-accessible curb ramps, and pedestrian actuated push buttons and signal heads. Additionally, existing crosswalks should be upgraded via the construction of curb ramps leading to signal buttons and the installation of pedestrian signal heads.
- Crosswalk markings and pedestrian crossing signalization may precede longitudinal sidewalk construction in areas where intersections are improved. The potential impact of crosswalk installation is minimal, with pedestrian crossing times at signalized intersections causing a slight delay to traffic and only when signal heads are actuated by pedestrians.
- Due to the current traffic volumes and speeds in much of the study area, the location and treatment options of additional crosswalks should be evaluated for durability, visibility, and consistency with the streetscape of the surrounding area. Longitudinal (continental style) crosswalk markings are recommended for use at sidewalk and trail crosswalk locations that have high vehicular traffic volumes in the study area. These crosswalks provide the best visibility for drivers and pedestrians. This crosswalk marking type is preferred over decorative treatments due to superior visibility and lower maintenance cost on high volume roadways.
- The use of decorative pavement markings in lieu of retro-reflective pavement markings should be reserved for low-speed areas and are generally utilized in a downtown or village center district when combined with complementary streetscape amenities or enhancements. Decorative pavement markings combined with raised marked crosswalks (also known as speed tables) employ vertical deflection to force motorists to slow down upon approaching the crosswalk. Raised crosswalks are often used to create a safer and more comfortable pedestrian environment. It should be noted, decorative pavement materials are susceptible to deterioration when exposed to high traffic volumes and high turning movements. The decorative pavement markings combined with textured crosswalks are to be utilized in the northern segment where speeds will be reduced to 25-30mph. The decorative pavement markings for crosswalks will be utilized throughout the corridor.

- Additional stop and yield lines, a transversal pavement marking, will be used to instruct drivers where to stop or yield when reaching an intersection or mid-block crosswalk.





Legend

Segment

- Northern Segment
- Central Segment
- Southern Segment

Town Boundary

- Proposed Pedestrian Push Button
- Pedestrian Push Button

Crosswalk

- Proposed Crosswalk
- Crosswalk

CT Rail

- CT Roads

Figure 40

N

CT Route 229 Corridor Study

Proposed Pedestrian Facilities ALL Segments

Architecture Engineering Environmental Land Surveying Companies

Bike Enhancements

CT Route 229 corridor has sections of the roadway, where there are shoulders that are 6ft wide or more, which are generally considered adequate for bicycling. However, relatively high traffic volumes, vehicular speeds, and roadway grade in the corridor are concerns for cyclists. As discussed in focus areas, various improvements have been integrated into the large-scale and long-term preferred concepts for the corridor that will encourage reduced speeds and increase driver awareness of both bicyclists and pedestrians within these areas.

The City of Bristol is in the process of developing a bike path network as illustrated in [Figure 41](#). The study corridor is an integral part of providing north-south connection to the eastern part of the city. Furthermore, it provides several east-west junction points with downtown and commercial areas. When developing the bike enhancement concepts along the corridor, several guides were used in determining the best type of facility to provide comfort for all types of potential users (advanced bicyclists, basic riders, families with children, older persons, etc.)

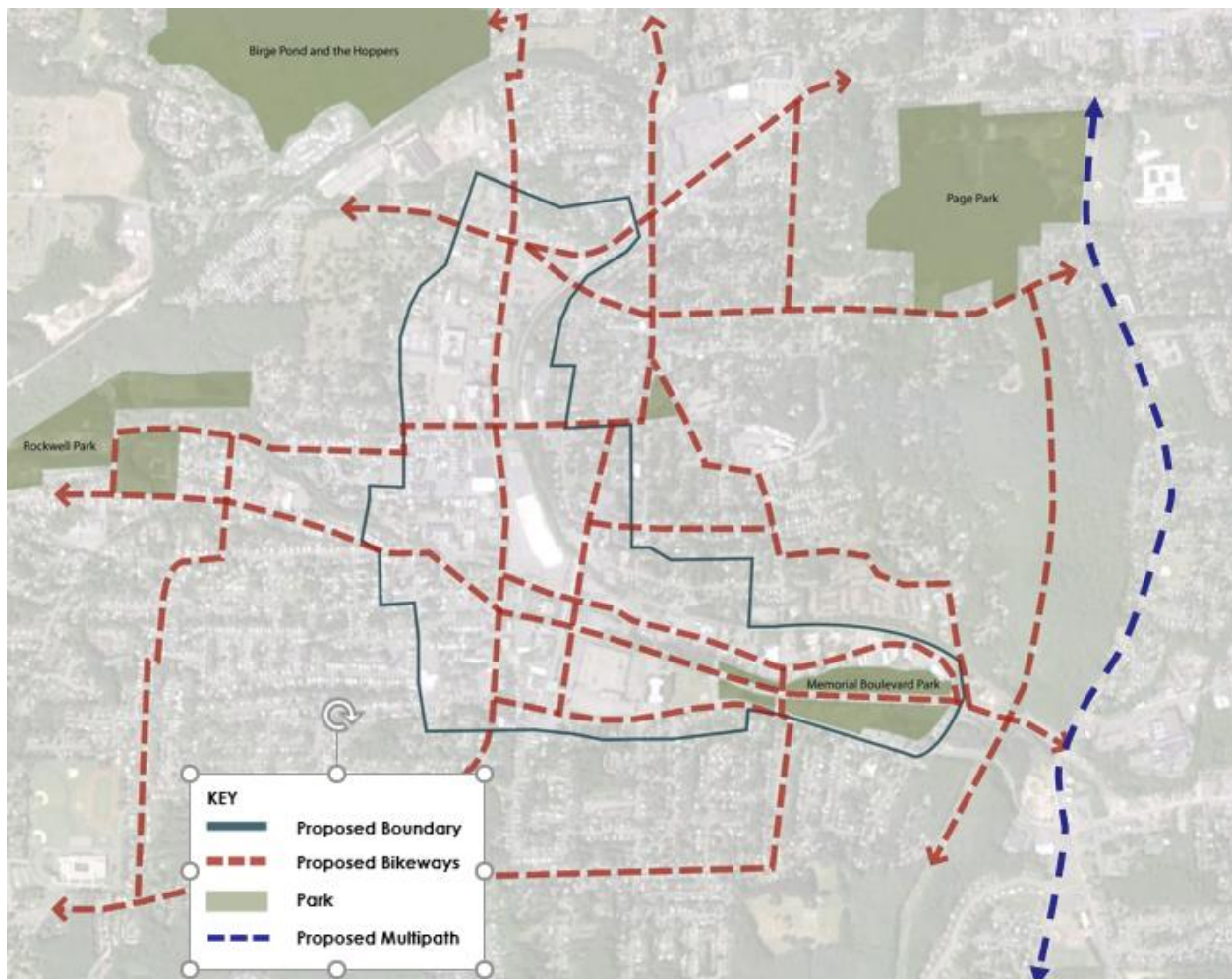
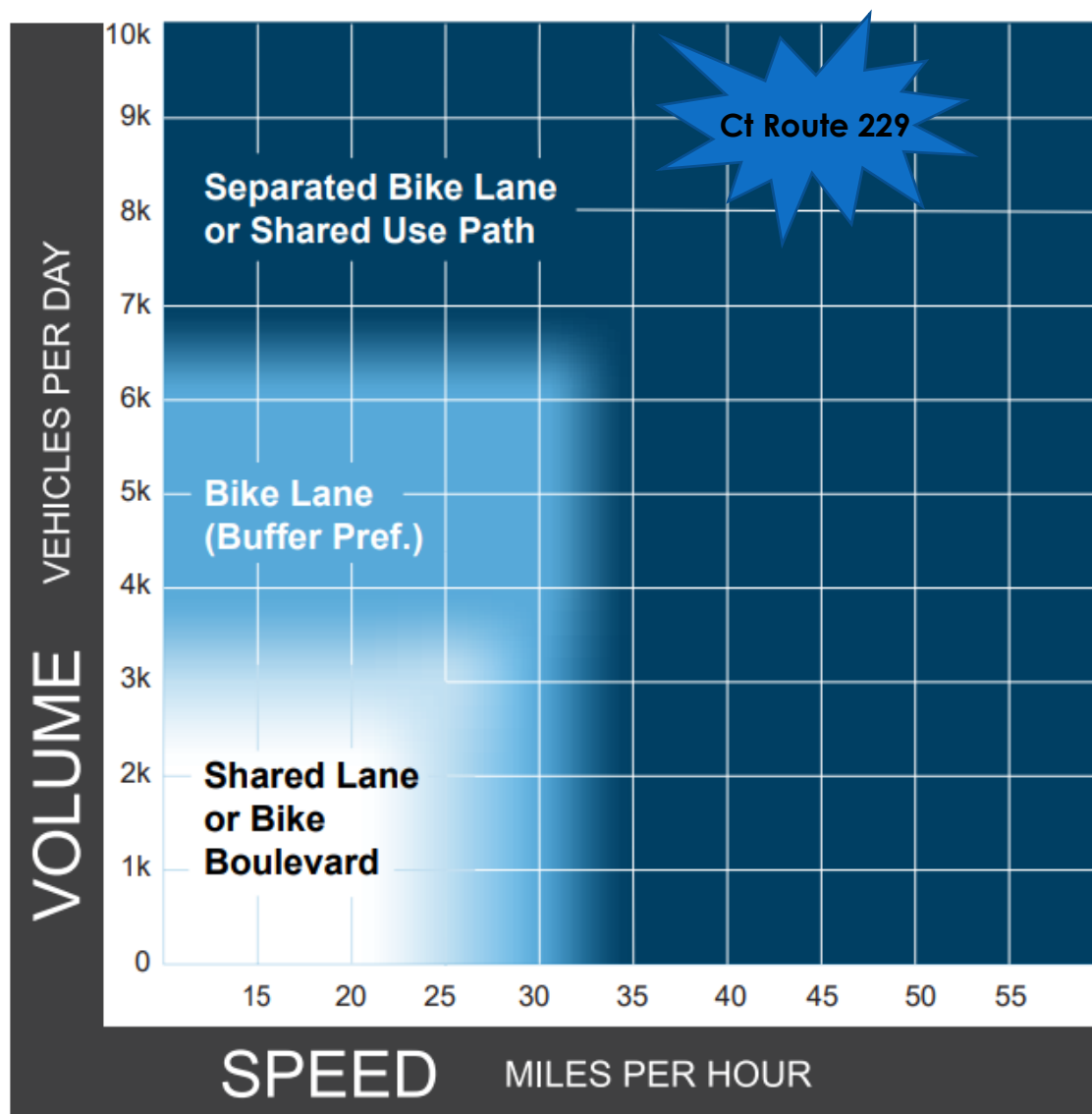


Figure 41 Bristol Bike Path Network Concept

Noting the lack of separation from traffic moving at 40-50mph would be an unforgiving design that decreases comfort and safety during passing events and while operating in darkness, interested but concerned bicyclists will not feel comfortable operating on the roadway, feeling the highest *Level of Traffic Stress*. Based on the volumes and speeds on CT Route 229, using the FHWA standards, as illustrated in [Figure 42](#) a physically separated bicycle lane or shared-use side path is recommended.



Notes

- 1 Chart assumes operating speeds are similar to posted speeds. If they differ, use operating speed rather than posted speed.
- 2 Advisory bike lanes may be an option where traffic volume is <3K ADT.
- 3 See page 32 for a discussion of alternatives if the preferred bikeway type is not feasible.

Figure 42 FHWA Bikeway Selection Guide

AASHTO describes a shared-use path as infrastructure that supports multiple recreation and transportation opportunities, such as walking, bicycling, inline skating, and wheelchair use. A

shared-use path typically has a surface that is asphalt, concrete, or firmly packed crushed aggregate and is physically separated from motor vehicle traffic by an open space or barrier immediately adjacent and parallel to a roadway. Through the entire length of the corridor, from Southington I-84 westbound off-ramp (Exit 31) to Farmington Avenue in Bristol, a ten-foot wide shared-use path is proposed on the northbound. The shared-use path would be constructed at a minimum offset of five feet from the existing edge of CT Route 229. Following AASHTO's Guide for the Development of Bicycle Facilities, this buffer distance is provided for safety and comfort of path users. Where the five-foot separation cannot be provided due to site constraints guiderail would be provided.

Figure 41 illustrates the proposed bike paths for the city of Bristol; however, it should be noted, there are other studies in the vicinity of the CT Route 229 Corridor with possible improvements for the overall multimodal network. Farmington Canal Heritage Trail (FCHT) is generally located to the east, and it is the most popular multi-purpose trail in the state. Under the Gap Closure Study for CROG, the trail is planned to be extended into northern Southington and Plainville, thus possibly presenting an opportunity to connect with the proposed network by the city of Bristol and creating additional opportunities for the town of Southington. Similarly, the southern part of the Tunxis Trail, a 79-mile blue-blazed trail, runs from the Wolcott line atop South Mountain north through Southington to Bristol. This trail currently ends at the Park and Ride Lot on Lake Avenue. The proposed multi-use trail on CT Route 229 presents an opportunity to extend the trail to the Pequabuck River and improving access from downtown Bristol to a network of statewide trails.

In addition to these improvements, there are opportunities for other stand alone, small-scale improvements in the study corridor that can improve bicycle facilities and thereby improve safety and accessibility for cyclists.

Bike Parking

Provide appropriate bike parking at key destinations. Bike parking is an important component of a bicycle transportation system. It is as necessary to bikes as a parking space is to a car. Racks should be placed throughout the commercial developments, particularly at destinations for recreational users coming from local parks such as Page Park and Casey Field. Additionally, bike lockers should be placed at the Park and Ride facility at Lake Avenue in the study corridor.

The placement of bike lockers at the Park and Ride locations gives commuters the option of riding to these facilities from their home and securely parking their bicycle during the day while at work, thereby eliminating the use of a single occupant vehicle for commuting.

Transit Enhancements

The 2018 Comprehensive Service Analysis Report prepared for the Capitol Region Council of Governments (CROG), in partnership with CTtransit and the Connecticut Department of Transportation (CTDOT) has identified service improvements and many opportunities for capital investments that support transit service and to make it more attractive to existing and potential riders. These improvements include three main categories: passenger facilities, pedestrian access, and bus routes, stop spacing, and consolidation.

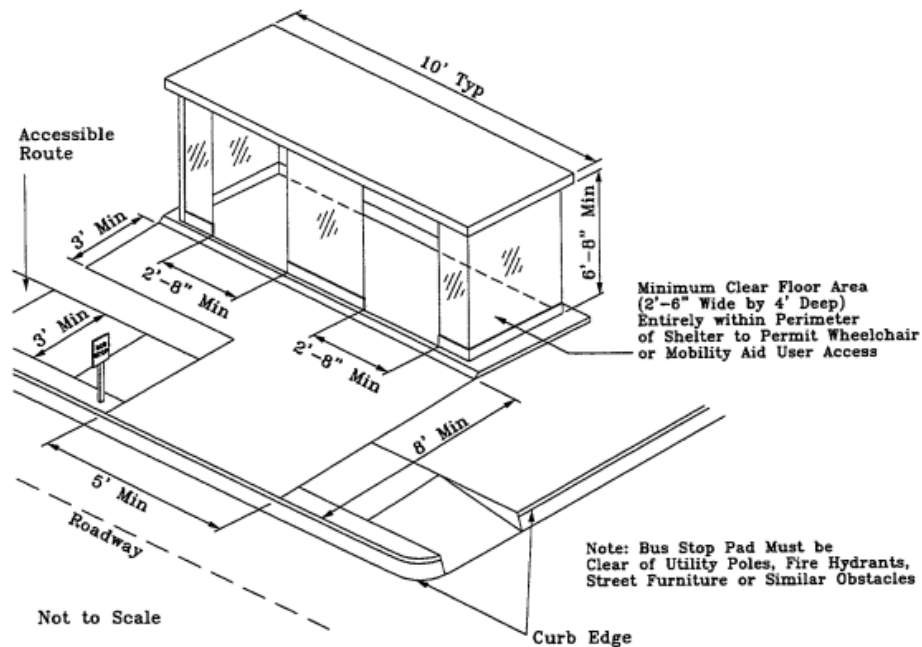
Passenger Facilities

Pedestrian facilities are an integral part of the development plan for transit enhancements. Consider topography of roadway in placing pedestrian links that would serve as direct connections between bus routes, bus stops, and commercial and residential properties along roadway. Certain key bus stop design characteristics are essential for ensuring a high-quality transit experience. While it is not possible for every stop to be perfectly designed, there are a number of principles for good bus stop design and locations:

- Convenient, Comfortable, and Safe Locations
- Visible and Easily Identifiable
- Real-time Information on Available Services
- Pedestrian and Bicycle Access
- Integration with Surrounding Development
- Amenities that Make the Wait Comfortable

Bus Shelters and Waiting Areas of sufficient size to accommodate an ADA compliant landing pad (required for the operation of wheelchair lifts) are recommended at all bus stop locations. Bus shelters and benches are also recommended where space and sight-lines (shelters should not obstruct critical sight-lines at intersections) permit. Bus shelter designs should be selected in coordination with both towns, to ensure that shelters are architecturally suitable for each community.

The preferred surface for the ADA compliant landing pad is concrete. The pad must be a minimum of 5 feet wide by 8 feet deep without obstruction within that area. When accompanied by a shelter, the landing pad may extend into the shelter, providing there are no obstructions such as shelter posts or benches. Shelters typically range in depth from a minimum of 4 feet to 6 feet and range in length from 8 feet to 18 feet. Benches are only provided if the shelter is large enough to accommodate without obstructing with the ADA landing pad area if that area falls within the shelter. [Figure 43](#) illustrates the dimensions of ADA compliant bus stop with shelter and landing pad. At a location with limited space to maintain ADA sidewalk width requirements, Simme seats are proposed at bus stops where bus shelters can't be provided. Simme seats provide two individual seats attached to an octagonal bus stop pole. This innovative arrangement allows bus stop designers to position the seat to fit in difficult locations. [Figure 44](#) shows seating in a parallel position that minimally affects the main sidewalk right-of-way and allows for uninhibited use of the pathway.



Note: Graphic from TCRP Report19: Guidelines for the Location and Design of Bus Stops

Figure 43 Shelter Design Example to Meet ADA Requirements



Figure 44 Sample of Simme Seats at Bus Stops

At bus shelter location, additional amenities such as trash can, variable message sign showing the bus arrival time, phone charging station, bike rack or bike locks, waiting pad, crosswalk should be considered. These amenities, along with landscaping and shade, can attract transit users and improve the environment for pedestrians.

Pedestrian Access

Sidewalk construction is recommended for CT Route 229, which would greatly improve pedestrian mobility from all bus stops along those routes. Where sidewalks only serve one side of the roadway, crosswalks are recommended at signalized intersections to access bus stops on the opposite side of the roadway. Expansion of the sidewalk network would connect bus stops to residences, places of employment, and goods and services.

Bus Routes

The 2018 Comprehensive Service Analysis Report has identified service improvements including changes to the existing bus routes within the study area, surrounding neighborhoods, and the entire Hartford District System. The improvements recommended under the preferred service scenario (Phase 3) address several issues identified through technical analysis and public input for the entire Hartford District which included: streamlining and simplifying their services, providing new coverage and crosstown services, and reducing redundancy in services.

Roadway improvements associated with the recommendations of this report will impact several bus routes: 502, 542, and 541 as well as associated bus stops. [Figure 45](#) illustrates the Bus Routes and Stops under Phase 3 recommendations.

Bus Route 102:

The CTfastrak bus Route 102 would remain unchanged.

Bus Route 502:

The proposed Route 502 would operate between New Britain and Tunxis Community College instead of two downtown areas from New Britain to Bristol. The updated path would turn into Farmington Avenue instead of continuing along Pine Road and South Street to the downtown center.

Bus Route 541:

The proposed Route 541 would connect downtown Bristol and Bristol Senior Center via North Main Street, Farmington Avenue, Jerome Avenue, Stevens Street, and Stafford Avenue. The bus route would no longer extend to Tunxis via Farmington Avenue, instead, it would end at the Bristol Senior Center.

Bus Route 542:

The proposed Route 542 would provide a new service connecting Bristol and Plainville to Southington. Originally, bus route 542 served the core of Bristol downtown, while the newly proposed bus route would be a crosstown service. The proposed route would be operating via West Street, West Queen Street, and Queen Street, along with service to the Plantsville Park-and-Ride on South Main Street/Route 10. Connections to other routes would be available at the Lake Avenue Park & Ride, downtown Bristol, and Connecticut Commons in Plainville.

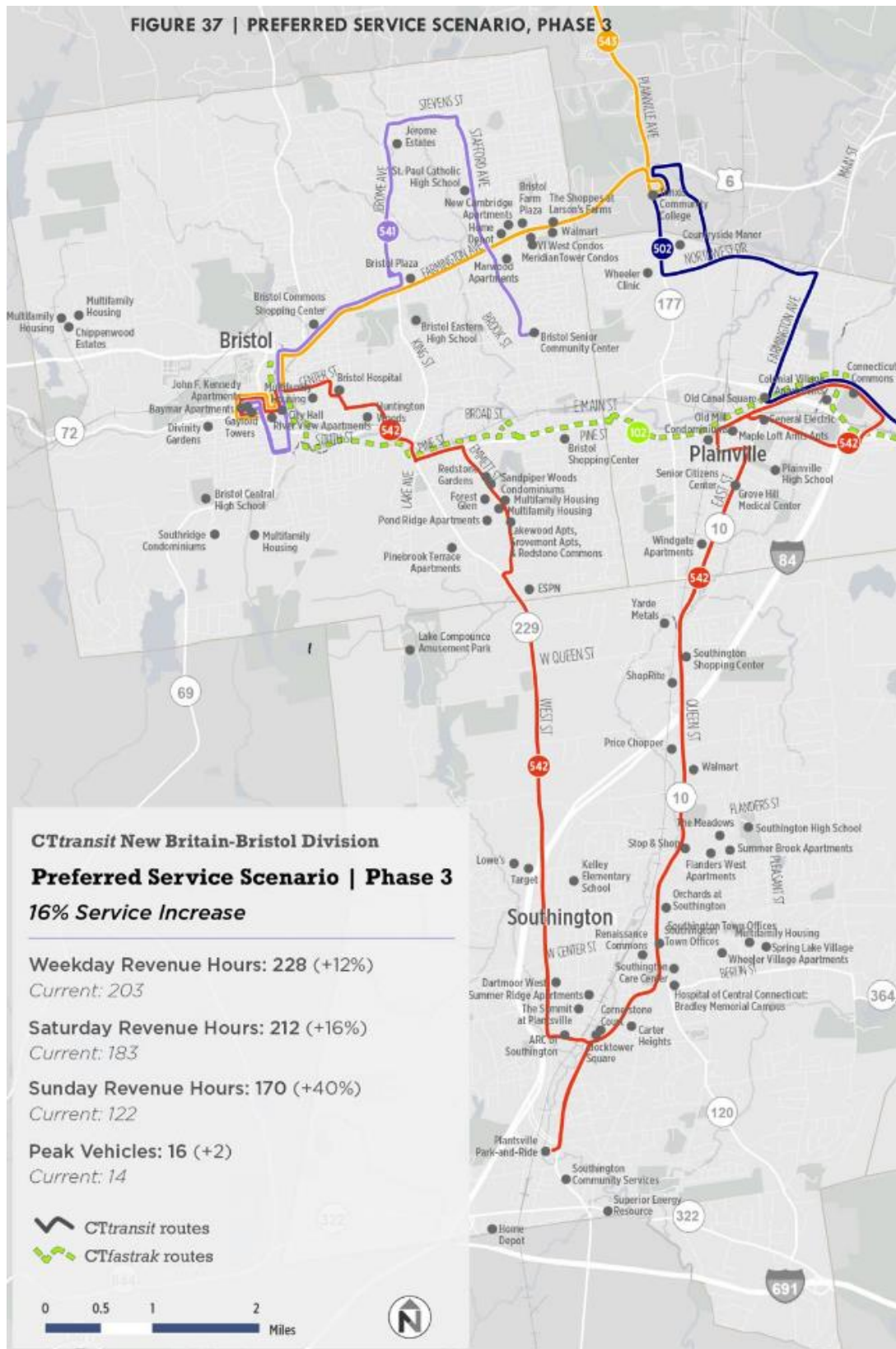


Figure 45 2018 Comprehensive Service Analysis, Phase 3 Recommendations

In discussions with the CTDOT and CTtransit additional proposed bus routes were discussed that better serve the corridor and destinations nearby.

CTtransit believes in utilizing spoke–hub distribution paradigm as a form of transport topology to optimize and organize bus routes as a series of "spokes" that connect outlying points to a central "hub". Downtown Plainville, Bristol and Southington are potentially the hubs, while the CT Route 229 corridor can be identified as "spoke" with destination points. The Hub also allows passengers to transfer between different Bus Routes or transportation modes. **Figure 46** illustrates the existing hub-spoke number of average weekday trips utilizing statistics from 2018 Comprehensive Service Analysis Report.

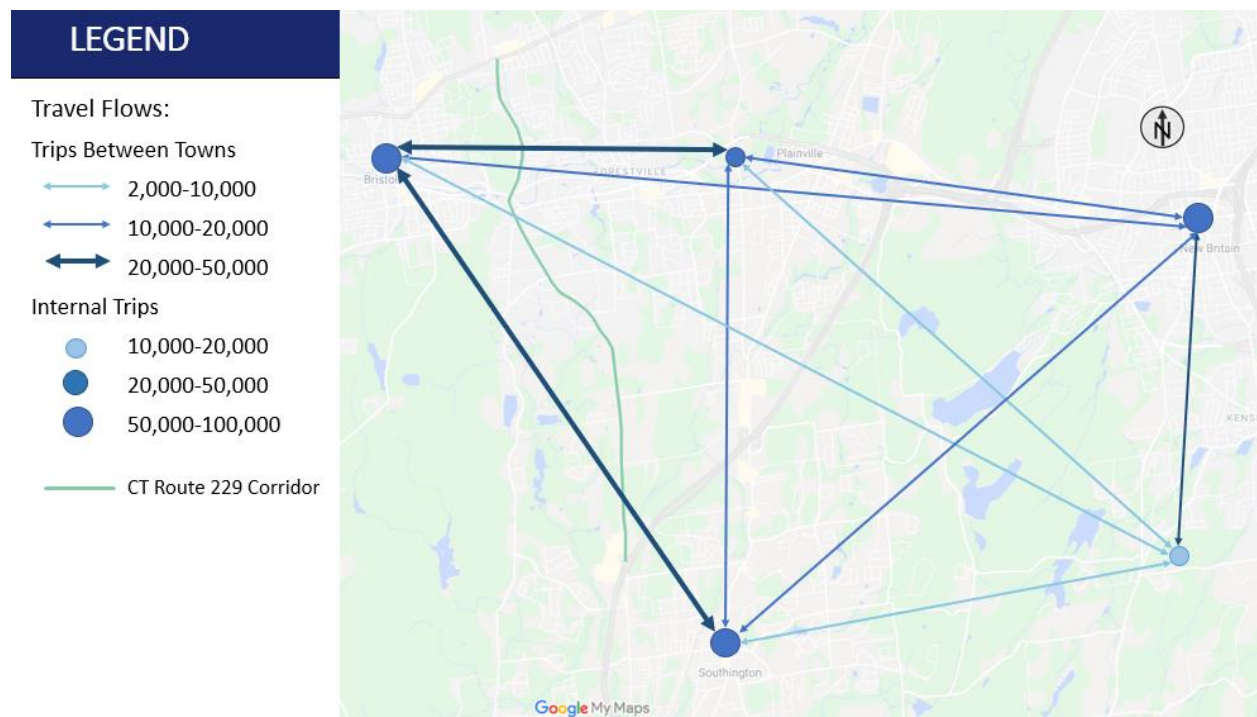


Figure 46 Hub – Spoke 2018 Travel Trip Patterns

The graphic illustrates volumes of average weekday trips per municipality, utilizing the 2015 trip tables produced by the CRCOG Regional Travel Demand Model. A high volume of daily trips exists between Southington and Bristol, where no transit services are provided.

Proposed Corridor Bus Route 542:

The CT Route 229 corridor is a perfect "spoke" providing a direct connection between Southington and Bristol with key service areas as potential stops. **Figure 47** illustrates three proposed phases of the Route 542 expansion. Phase 1 of Bus Route 542 will continue to serve the core of Bristol downtown and extend to the town line with Southington. The loop would serve businesses along CT Route 229 on the outbound trip and Emmett Street on the inbound trip. Phase 2 expands the route further along the CT Route 229 with a turnaround at Executive Boulevard South shopping plaza. The last proposed phase, beyond the study area, would support downtown Southington with a looping route utilizing CT Route 229, Center Street, North Main Street, Queen Street, Spring Street, and return to CT Route 229.

The major point of destination and the proposed loops can be utilized as transit clock points.

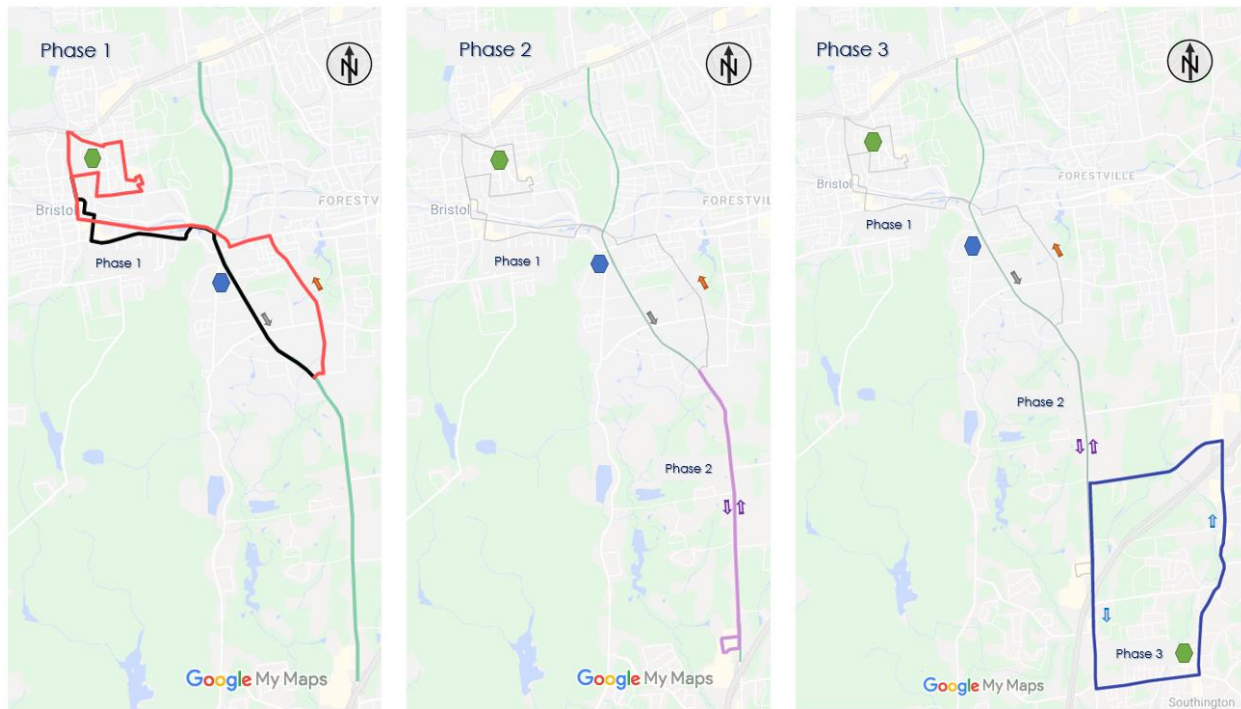


Figure 47 Proposed Rerouting of Route 542 and three phases

Proposed Corridor Bus Route 502:

Figure 48 illustrates the existing, Phase 3 of the 2018 Comprehensive Service Analysis Report, and the proposed rerouting of Route 502. To best serve the corridor, we propose to realign the segment to the west of the corridor and utilize Route 72 extension as well as the proposed improvements along Memorial Boulevard by other studies.

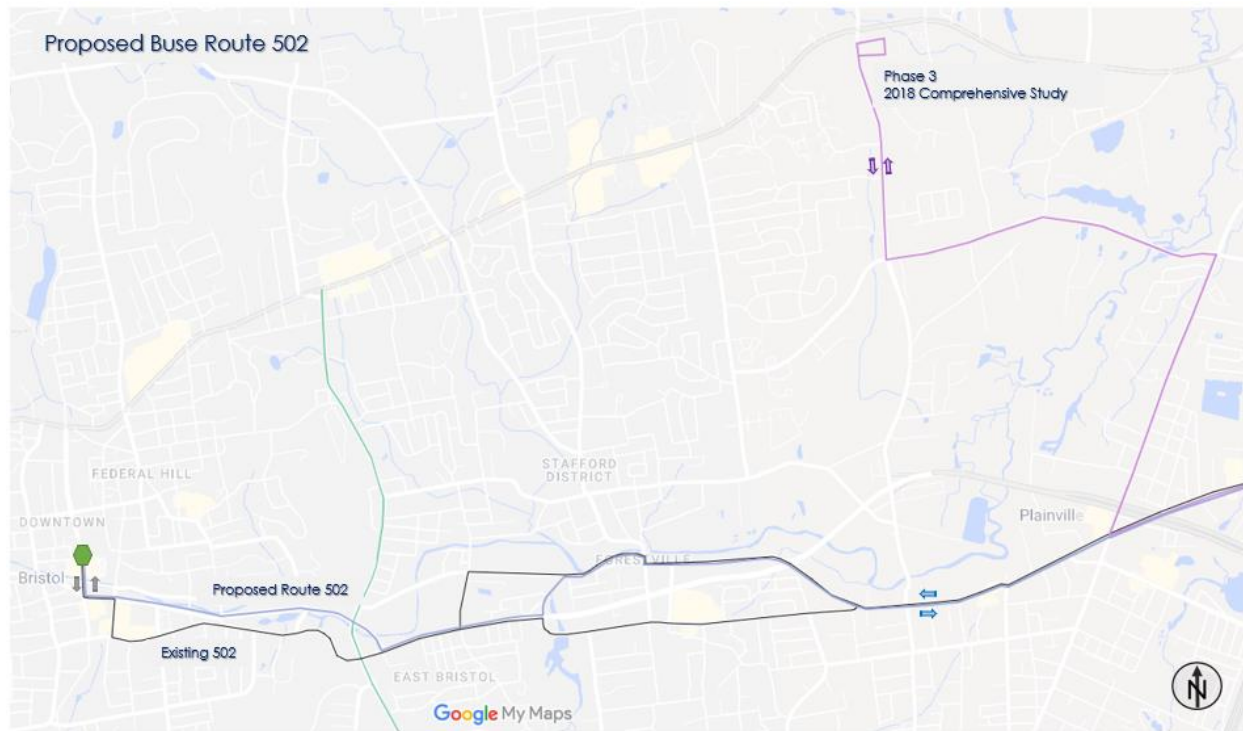


Figure 48 Proposed Rerouting of Route 502

Bus Stops

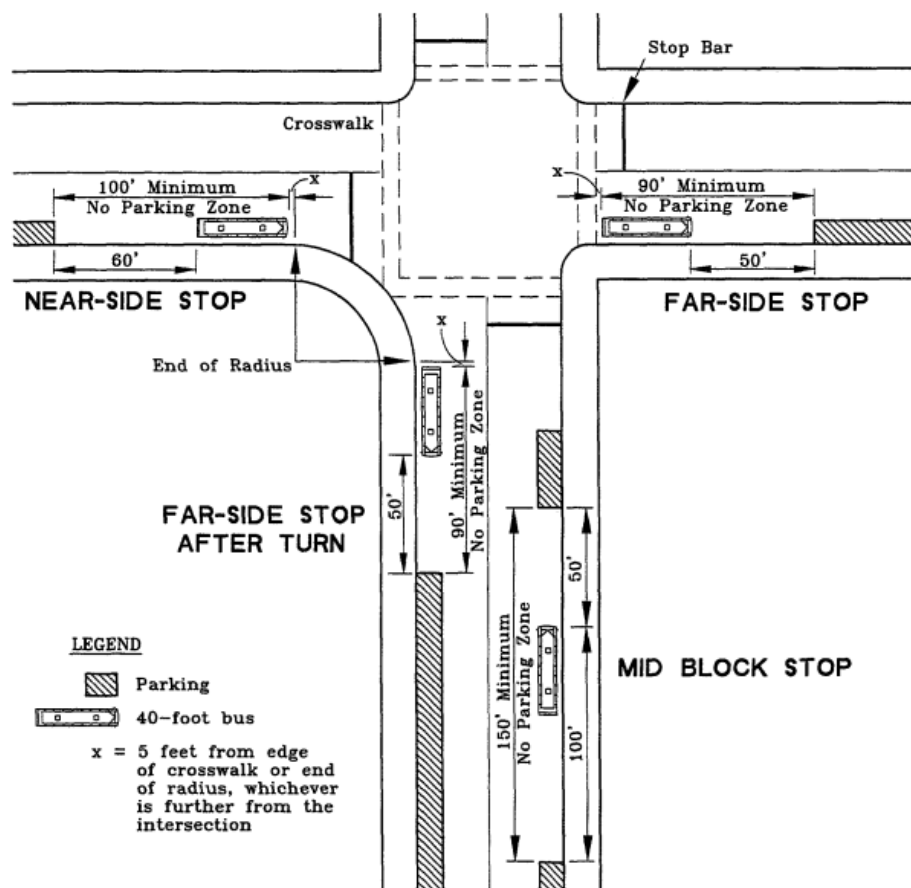
These new stops replace stops that are impacted by recommended roadway improvements and are intended to provide service to areas along the corridor that are not currently served by stops. Suggested new bus stop locations include:

- TRIDENT - RT-72 Extension (inbound / outbound)
- TRIDENT - Riverside Ave (inbound / outbound)
- TRIDENT - Middle St (CT Route 229) (inbound / outbound)
- Lake Avenue Park-and-Ride (inbound / outbound)
- Near ESPN Campus (inbound / outbound)
- Apartment Complexes on Emmitt Street – (Lakewood Apt and/or Sandpiper Woods Apt)
- Shopping Plaza - Executive Boulevard South (possible turnaround and transit clock point)
- Southington Downtown – including Town Offices.

Since bus stops provide the interface points between the walkway system, the roadway network and the transit system, the proper location is critical. The placement of stops varies by location, however, the general considerations for the placement of bus stops at intersections are:

- Ideal spacing is one stop every quarter to half mile (1320-2640ft)

- **Figure 49** illustrates typical dimensions for on-street bus stops and their location relative to an intersection based on APTA guidance. When the route alignment requires a left turn, the preferred location for the bus stop is on the far-side of the intersection after the left turn is completed.
- When the route alignment requires a right turn and the curb radius is short, a mid-block location is preferred. If a mid-block stop is not possible, the stop should be located on the far-side of the intersection after the bus completes the right turn movement.
- If there is a high volume of right turns at an intersection, the preferred location for the stop is on the far-side of the intersection. If there is not a high volume of right turns at an intersection, then a near-side stop is acceptable. In circumstances where the accumulation of buses at a far-side stop would spill over into the intersection, then a near-side is preferred.



Notes:

- 1) Add 20 feet to bus stop zones for an articulated bus.
- 2) Increase bus stop zone by 50 feet for each additional standard 40-foot bus or 70 feet for each additional 60-foot articulated bus expected to be at the stop simultaneously. See Table 3 for the suggested bus stop capacity requirements based on a range of bus flow rates and passenger service times.

Figure 49 APTA Typical Dimension for On-Street Bus Stops

Gateway & Wayfinding Signage

Within the Study Area, there are several business centers with decorative signs and landscape elements that invite and inform a driver and pedestrians of their location and access point. For example, ESPN has a large sign with its logo, while the “Southeast Bristol Business Park” - highlights the entrance to industrial /commercial developments as shown in

Photo 11.



Photo 11 Sample of Existing Gateway signs

Within the corridor, we propose utilizing similar “gateway” signs near selected intersections where the nature of the corridor changes. Monuments or decorative stone walls with signs at entry points could draw even greater attention to the importance of the location and create unique identities for each of the segments. Multiple gateway treatments could be considered for use at key locations throughout both communities. **Figure 50** illustrates a sample of a column that considers two viewpoints for the city of Bristol at the northbound corner with Route 72 extension and Riverside Avenue.

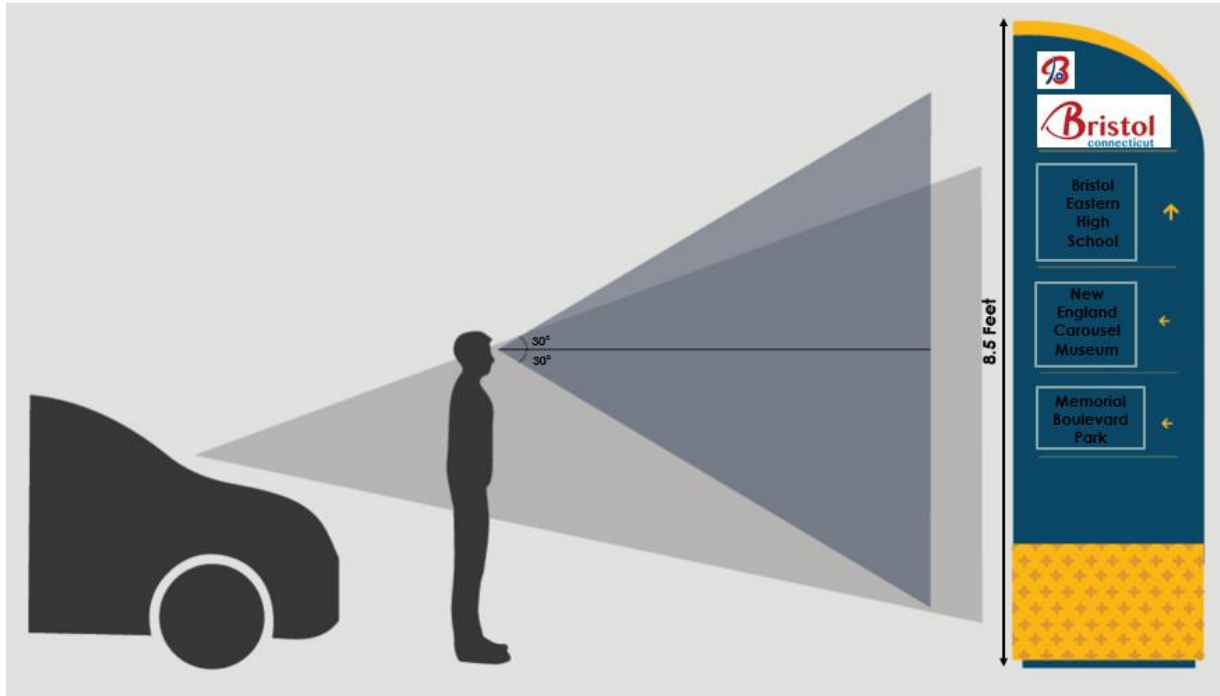


Figure 50 Sample of a Gateway monument in Bristol

Figure 51 illustrates a Gateway monument with wayfinding's information for southbound movement to the north of Enterprise Drive. The wayfinding information includes in this example, directions to Lake Compounce, ESPN, and Downtown Southington.

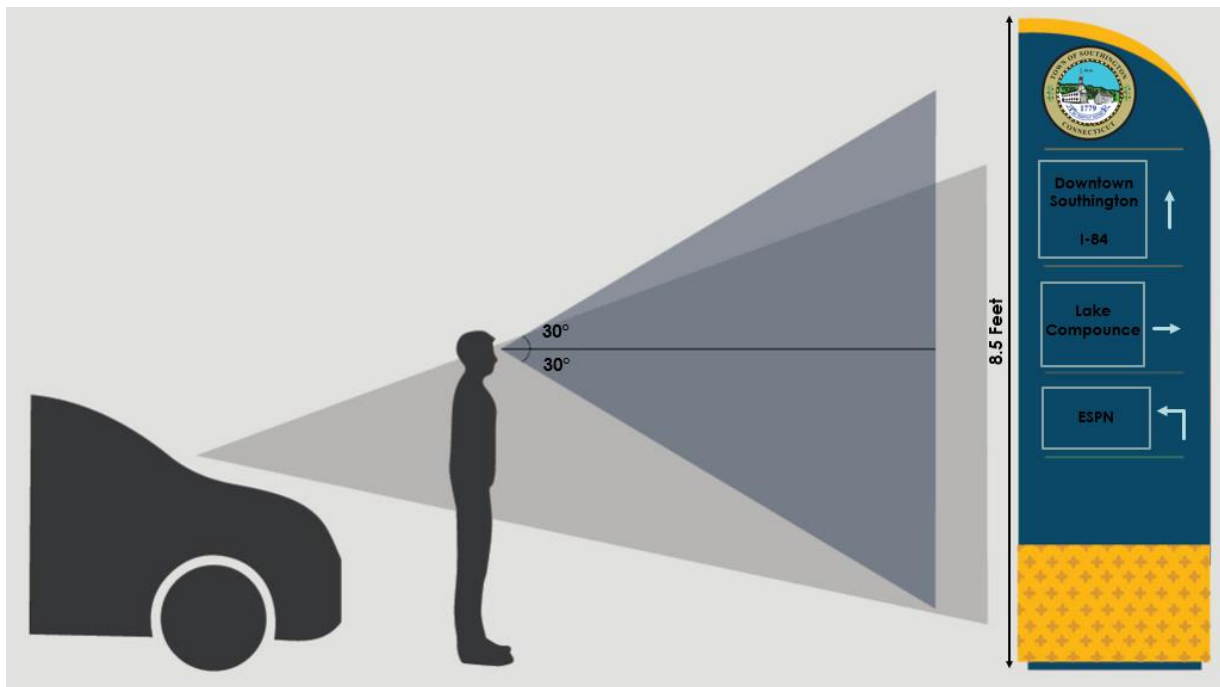


Figure 51 Sample of a Gateway monument In Southington

When designing gateway wayfinding signage, there are a few items to consider:

- Community branding of wayfinding signs across multiple corridors
 - The overall style, color, layout, font, and size.
- Who will the sign serve: multi-use trail users, pedestrians and/or vehicles
- Type of information included on the sign
- Symbols/maps/pictograms to illustrate the message along with post arrows
- Placement- if the sign is competing for visual attention
- Other supplemental wayfinding elements, such as information kiosks, mile markers of the path, pedestrian directional signs, etc.

Where sufficient space allows, monumental columns should be accompanied by low maintenance landscaping such as annual and perennial flowers and small flowering bushes that would not obscure the landmark. A few locations that lend themselves for such treatments include:

- Trident Area
 - Southeast corner of the Broad Street intersection
 - Northwest corner of the Lake Avenue intersection
- Woodland Road
- South of ESPN Drive
- South of West Queen Street.

In addition to gateway and wayfinding signage an overall theme can be created that includes decorative pedestrian-scale lighting, street signs, informational signs, historical plaques, street trees, landscaping and other streetscape amenities to transform the corridor and provide a sense of “place” that is consistent with the vision of specific sections or for the overall corridor in general. These various treatments could provide a visual rhythm and define the space of the streets as portals leading to various destinations.

Access Management

Access management is the proactive management of vehicular access points to land parcels adjacent to roadways. Good access management promotes safe and efficient use of the transportation network and encompasses a set of techniques that state and local governments can use to control access to their roadways.

The focus of access management is on safety and minimizing vehicular conflict points which, in turn, helps to maintain traffic flow along a roadway. Maintaining traffic flow has the potential to reduce the need for roadway capacity improvements as fewer conflict points help reduce delays for through traffic. Sound access management also facilitates economic sustainability because it establishes a safe and effective relationship between the local transportation system and adjacent land use. Ease of access is an important factor influencing customer decision-making about which businesses to patronize. Access management can ensure that motorists reach local businesses easily and safely and that access for new developments will not create a safety risk. The goal of the access management component of this study is to encourage CTDOT, the municipalities, and

private property owners to pursue and implement practical and feasible access improvements to the benefit of traffic flow and overall safety.

The access management recommendations in this section include:

- Corridor-wide access design guidelines
- Land Use & POCD amendments
- Site-specific commercial access improvements

Corridor-wide Access Design Guidelines

Design guidance from the Transportation Research Board's Access Management Manual (TRB, 2005) and CTDOT's Highway Design Manual (HDM, 2003) were consulted to develop the following baseline criteria for access design along the CT Route 229 corridor. In general, the respective municipal zoning provisions for access management should include these access design criteria.

- Curb cuts and roadway intersections should meet at a 90° angle wherever possible; one-way driveways should intersect public streets at a 60° angle or greater; two-way driveways should intersect public streets at a 75° angle or greater.
- Access drives should not be located within 125 feet of an intersection.
- Where a driveway distance of 125 feet from an intersection cannot be achieved, driveways should be located as far from the intersection of the street lines as is practical; regardless, access drives should not be, to the extent feasible, located within the functional area of an intersection (maneuvering area and area of vehicle queuing at an intersection).
- Access drives on the same side of the street should be separated as far apart as is practical, with a target minimum separation of 60 feet for residential drives and 125 feet for commercial drives.
- Sight distances from major commercial access drives should meet the intersection sight distance (ISD) requirements of the HDM. Since the commercial developments are mostly in the central and southern segments where the posted speed limits are 30mph and 40mph respectively, the ISD value ranges between 390 feet and 500 feet.
- All curb cuts and/or roadway intersections on opposite sides of the street should be aligned directly opposite one another.
- Internal circulation among adjoining properties should be provided where possible; driveway consolidation among adjoining properties and shared driveways should be provided where possible.
- Access drives should be provided to lower classification streets whenever possible. That is, access should be provided to collector roads or local streets that intersect with CT Route 229 rather than directly to it, where that option exists.
- Properties with 150 feet or less frontage should have no more than one curb-cut.
- Where a property has more than 150 feet of frontage, two entrances/curb-cuts are acceptable, provided there is a minimum of 1/3 of the frontage area separating the two curb-cuts.
- Where a property has multiple curb-cuts, redundant access drives should be eliminated.

- Entrance drives should not be excessively wide (more than 30 feet per HDM requirements).
- Curb edges should be clearly defined with islands and/or landscaping

Land Use, Zoning, and POCD Amendments

Zoning and other land use regulations can directly impact regional transportation systems and facilities. The City of Bristol and the Town of Southington each have distinct zoning districts established to meet their local long-term development objectives. Consequently, along CT Route 229, where the municipal boundaries meet, the zoning designations for Southington are inconsistent with those in Bristol. However, the three primary zone categories recognized are Residential, Industrial and Business. Other land uses present in the corridor include agriculture, community facilities, transportation right-of-way (ROW), and water. An access management overlay zone is recommended which is a special zoning district that is generally applied to properties along a roadway where development pressures, traffic congestion, and safety are of particular concern such as the central segment of the CT Route 229 corridor. This type of zone overlay will establish a set of criteria for the location, number, and design of all access points along the roadway within the geographic area it covers. It is applied as an “overlay”, which means that the use requirements and other standards of the underlying zoning district still apply to the affected properties. The access design standards established by an access management overlay zone are tied to the functional classification of the road being accessed. Elements that might be included in an access management overlay zone are:

- A set of definitions related to the terminology used
- An explanation as to how the requirements of the zone will be administered. Each municipality should adopt ordinances that would provide the Town Engineer and the Planning and Zoning Commission ability to comment on proposed design harmoniously related to the land and surrounding developments. The municipalities can define requirements such as:
 - Overall site plan information related to access design.
 - number and spacing of driveways relative to adjacent properties and intersections
 - Corner clearances
 - Length of driveway throats (to provide stacking room for waiting cars)
 - Sight distances
 - Location of opposing driveways
 - Double frontage lots
 - Emergency vehicle and transit access
 - Signal spacing and turn lanes
- Provisions for non-conforming access drives and resolution of situations where the standards of the zone cannot be achieved, such as shared driveways
- Provisions for regulatory relief or bonuses where particularly beneficial access design is proposed
- Standards for when a traffic impact report would be required to substantiate the proposed access design.

- Language should be included in both the ordinance and the Corridor Zone that refers the applicant to the general design standards for accessways and driveways, and states that those standards must be used as guidance in driveway design.

For new major developments outside of the access management overlay zone the requirements can be phrased in the form of performance standards, which are general statements of purpose intended to promote development that, for example:

- Makes efficient use of land, facilitating an economical arrangement of buildings, circulation, land use, and utilities
- Provides for uninterrupted pedestrian and bicycle paths, to the greatest extent possible
- Recognizes and is consistent with the character of adjoining residential uses
- Circulation and access designed in a manner that minimizes impacts on area streets
- Provides adequate space for public transit

Although access management focuses on vehicle conflicts and movements, it is recommended that the site design provisions in each municipality's zoning regulations also include discussion of pedestrian and bicycle access and the interface of driveways with sidewalks and multi-modal path. In general, driveways should be designed to avoid crossing a multi-modal path, when possible, and to minimize interruptions to sidewalk continuity. Facilities for pedestrian and bicycle passage, and wayfinding should be made part of site design. In additions, adequate provision for the space required to accommodate public transit riders.




Site-Specific Commercial Access Improvement




Based on the assessment of existing access points and corridor accident data under the existing conditions assessment of this study ([see page 90-97](#)), several locations were identified where there are opportunities to improve commercial access to address access management and safety issues. Improvement recommendations were developed for these locations to highlight access management opportunities, not to serve as a mandate for private property owners to modify their existing access. These improvements would be implemented over time as a contingency of the site plan review and approval process, if and when individual property owners seek approval for a change in use or change in development intensity on their respective properties.


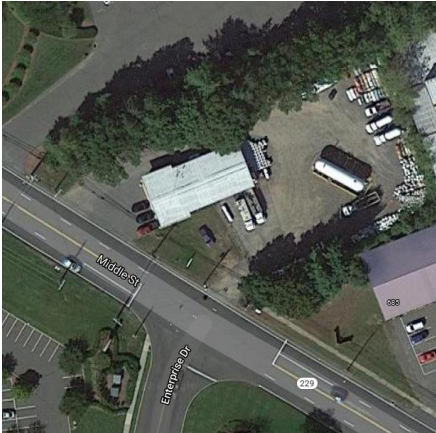

Where applicable, these improvements could also be implemented in conjunction with the other roadway recommendations of this study, or other roadway improvement projects undertaken by CTDOT in the corridor. In any case, the commercial access improvements will require additional planning and coordination with CTDOT, the respective communities, and the private property owners prior to implementation



The commercial access improvement recommendations are summarized in [Table 20](#).

Table 20: Summary of Commercial Access Improvement Recommendation

Location	Address	Identified Issue (s)	Recommendation(s)
	238 King St	The edges of the property in excess of 100ft serve as access/egress to the retail store.	Consolidate to maximum of two driveways from 6th St and New St. Narrow driveway to 30 ft maximum, or provide two separate one-way entrance and exit driveways separated by an island. Remove all access from King Street where multi-use trail will be provided along the east edge of the road. Consider corner clearances
	25 Middle St	Two driveways, one 30ft wide and second in excess of 60ft	Narrow driveway to 30 ft maximum, or provide two separate one-way entrance and exit driveways separated by an island. Consider shared access connections between adjoining
	45 Middle St	Two driveways, 30ft wide	Close one of the two driveways, or convert one or both of them to one-way entrance and exit. Consider closing one of driveways and utilize the space to provide turn-around point for parked vehicles.

Location	Address	Identified Issue (s)	Recommendation(s)
	45-63 Middle St	Several consecutive commercial driveways located along east side of CT Route 229. (Trident)	Consolidate one or more driveways and provide shared access to reduce the number of driveways. Consider providing lot interconnections between commercial properties and eliminating some driveway See "Focus Area" for details of possible access management improvements as part of Trident Improvements.
	258 Middle St	Two driveways, 30ft wide	Close one of the two driveways, or convert one or both of them to one-way entrance and exit. Consider closing one of driveways and utilize the space to provide turn-around point for parked vehicles.
	292-300 Middle St	Three driveways 30ft wide-two on Middle St and one on Battisto Rd.	Consider closing one of the Middle St driveways or provide two separate one-way entrance and exit driveways separated by an island.

Location	Address	Identified Issue (s)	Recommendation(s)
	430 Middle St	Two driveways, 30ft & 50ft wide	Consider closing the Middle St driveway
	675 Middle St	Two driveways, 30ft & 50ft wide	Narrow the northern driveway to maximum of 30 ft. The southern driveway as part of providing continuous sidewalk will have new driveway apron that is 30ft wide and will be made out of asphalt.
	1794 West St	30 ft & 50 ft wide driveways on Welch St, one 40 ft wide driveway on West St.	Consolidate the driveways on Welch Street Narrow down and define driveway apron on West St.

Location	Address	Identified Issue (s)	Recommendation(s)
 	1777 West St	One driveway on West St, and two on Curtis St.	<p>Consolidate to one driveway on Curtis St. The driveway closes to the CT Route 229 intersection should be moved further away from the intersection. The easterly driveway apron appears to be not utilized due to grade changes. The driveway apron should be removed.</p> <p>At minimum, increase the separation distance between the driveways in the process of narrowing if keeping the two driveways on Curtis St.</p>

Travel Speeds

The current design of CT Route 229, which provides for efficient and relatively high-speed travel between regional destinations, is generally not compatible with the desire to promote economic growth in development nodes, where safe access to local commercial and residential land uses will be required. Because the character of the roadway does not change sufficiently between the higher speed sections and lower speed areas, there are insufficient physical or psychological cues for motorists that would encourage a change in driving behaviors and a reduction in travel speeds.

The recommended designs of CT Route 229 are intended to encourage slower speeds by changing the character of the roadway and providing cues for motorists to reduce speeds. This includes specific design elements such as:

- textured and/or raised crosswalks that will slow down the vehicles
- narrower travel lanes (11 ft instead of 12 ft)
- landscaped snow shelves, including street trees, sidewalk, and lighting
- dynamic speed display signs in key locations

For the northern residential segment, we recommend a decrease of the existing posted speed limit from 35 mph to 30 mph with the outlined improvements above. In the vicinity of BEHS, a posted School Zone speed of 25 mph is recommended.

When changing or setting a speed limits we recognize this is a complex and often controversial process. The FHWA Safety unit recognizes four general approaches to setting speed limits:

- Engineering approach
- Expert system approach
- Optimization
- Injury minimization or safe system approach

Engineering and Expert System approaches are widely used in North America, while the injury minimization method is gaining wide-spread use in countries that are at the forefront of global road safety. When using the Engineering approach, a two-step process is typically utilized. The first step is to establish a base speed limit such as the 85th percentile speed or the design speed for the road. Next, the base speed limit is adjusted according to traffic and infrastructure conditions such as pedestrian use, median presence, number of intersections and driveways etc. This step requires the use of engineering judgment based on engineering and traffic investigation.

The recommended reduction in speed limit is based on the residential nature of this section of the corridor and to improve the safety there by reducing the crash frequency and severity. The reduction in speed limit will require additional planning and coordination with CTDOT and the respective communities before implementation.

Factors that affect safe speeds along roadways, and also influence the speed selected by motorists, include:

- A vehicle's mechanical condition and characteristics
- Driving ability/capabilities
- Traffic volume: vehicles, pedestrians, and bicycles
- Weather and visibility
- Roadway design elements, including
 - Road function/purpose
 - Lane and shoulder-width
 - Horizontal and vertical curves
 - Available sight distances
 - Driveways with restricted visibility and other roadside developments
 - High driveway density
 - Rural residential or developed areas and
 - Paved or improved shoulders.
- Pavement conditions; and
- Crash frequency and severity.

School Zone

A school zone starts at the front door and encompasses the campus and as many blocks as possible that surround the school and have a high concentration of school-generated

traffic. Often the school zone includes the streets along with the school and usually the area one to two blocks around it.

When establishing a school zone, two other boundaries should be considered:

- School Enrollment Boundary – a polygon that outlines the entire area around the school from which students are enrolled.
- School Walk Zone – within enrollment boundary, typically students living within a 1/2 mile or 1-mile radius are expected to walk to school and are not provided school bus services unless safe pedestrian access is not available.

The School Zone selected roadways, immediately adjacent to the school, should have special signing and pavement markings such as: crossing signs, speed signs, school zone pavement markings to alert motorists that they are in a school zone. **Figure 52** illustrates possible sign assemblies, which may include lights attached to the sign assembly. When lights are flashing, the school zone is in effect.

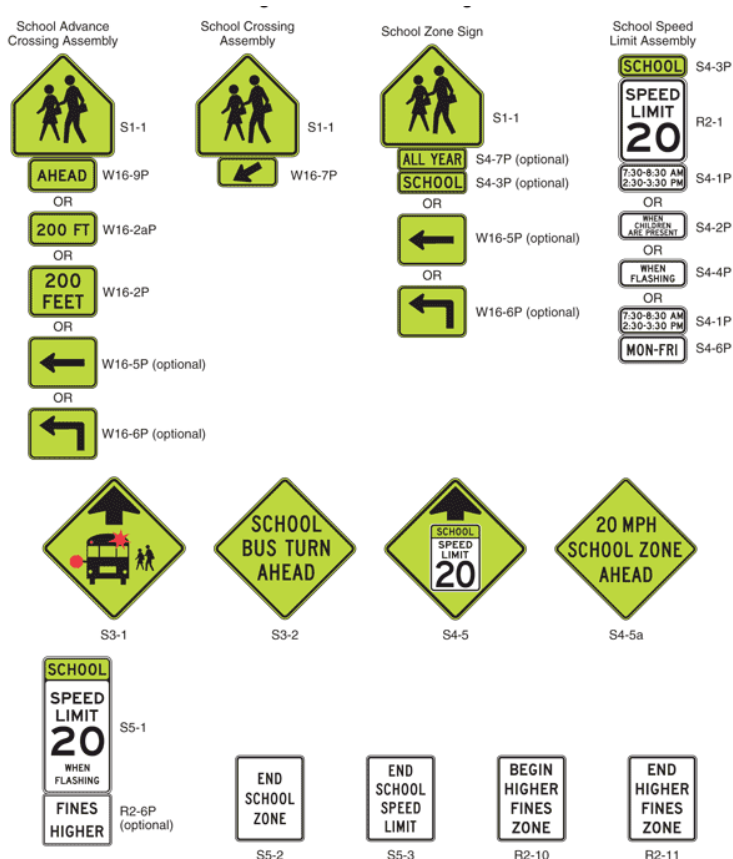


Figure 52 MUTCD School Area Signs (Fig 7B-1)

Within the study area, the segment between Louisiana Avenue and Stonecrest Drive is proposed to be included in school zone and the corresponding reduction of posted speed limit from 30 mph to 25 mph should be implemented.

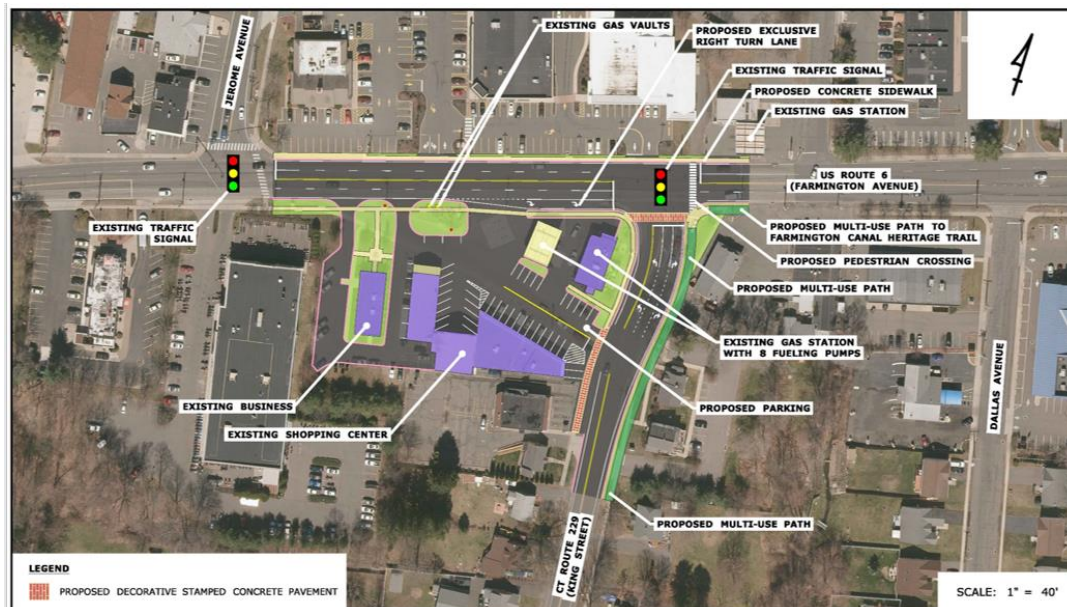
In addition, under CT Gen Stat § 14-212b (2012), the Office of the State Traffic Administration is allowed to designate any part of a state highway next to or close to school property as a school zone. A person that fails to comply with speed limit postings or violates the law within a school zone faces fines double the amount ordinarily issued for the same violation outside of a school zone. In other words, if a speeding ticket fine outside of a school zone would be \$100, it would jump to \$200 within a school zone.

A final selection of the proposed school zone boundary, signage, and reduced speed limit will require additional planning and coordination with CTDOT and the respective communities prior to implementation.

Focus Areas

Thirteen locations in the CT Route 229 corridor were identified by stakeholders as focus areas for in-depth study. The improvements and strategies developed for these focus areas propose to significantly change the character of Route 229 and/or adjacent land uses in order to address transportation issues, and to complement the long-term vision by each of the communities. The focus area recommendations are generally comprehensive in that they address all of the various safety, mobility, and accessibility issues within the focus area. The conceptual ideas in the plan were based on sound analysis, stakeholder engagement and creativity. The plan is envisioned to be a 10-year vision to guide future development and affect positive change for the study area. Critical to the long term success of the plan is a broad -level of support from both stakeholders and civic leaders A full page rendering are provided in the [Appendix J](#) and cross sections of selected locations in the [Appendix K](#).

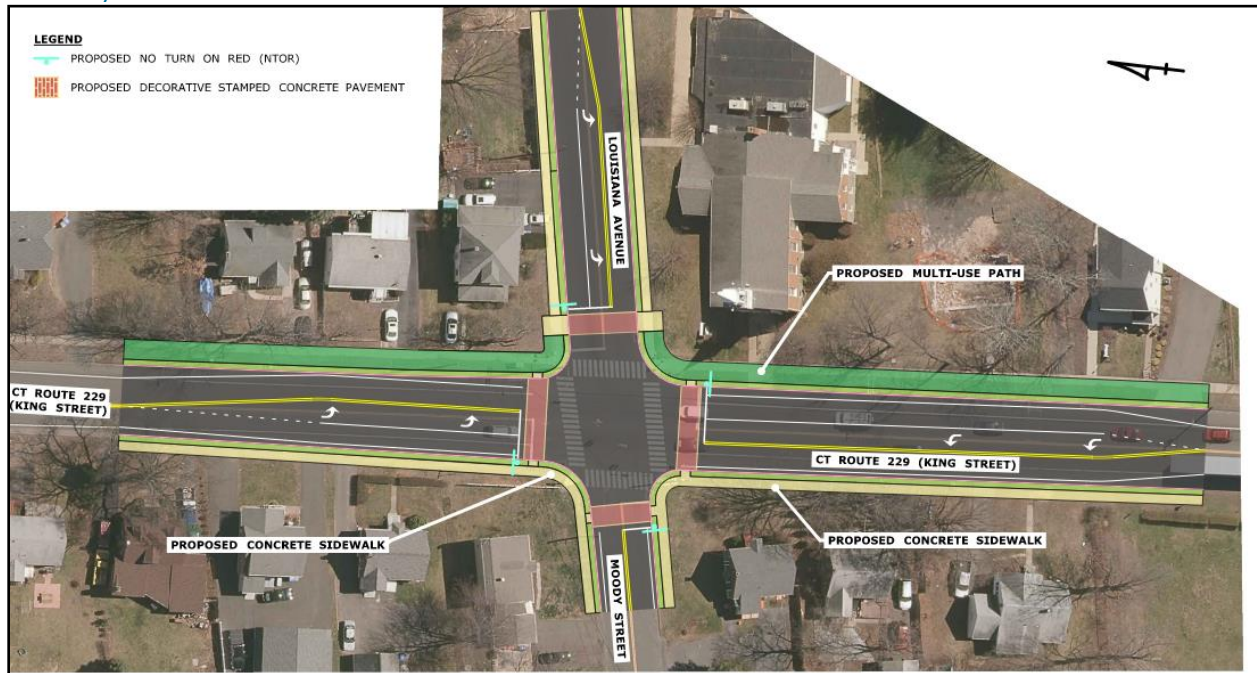
Location 1: Northern Segment: Intersection of King Street and Farmington Avenue



Location 1: Spot Improvement: Intersection of King Street and Farmington Avenue

Location 1 illustrates a proposed redesign of CT Route 229 / King Street at US Route 6 / Farmington Avenue to address congestion and traffic safety concerns. The intersection experiences a high number of collisions and with additional traffic growth, the future conditions are expected to exacerbate both existing traffic congestion and safety issues. The proposed concept closes off the Y-turn into King Street Extension while providing a continuous sidewalk on the west side of King Street and multi-use path on the east side. Defined parking along both sides of King Street Extension is provided for businesses around the area. The access to the King Street Extension is limited to King Street for in/out movements. Access to the corner gas station on Farmington Avenue is maintained and could be used to access the parking. Landscaping and additional green pocket spaces are provided along Farmington Avenue. In addition to the sidewalk and multi-use path, crosswalks and access to shopping plazas to the north will be provided. Options to completely close off King Street Extension were evaluated, but not pursued due to the significant impacts to commercial properties along the King Street Extension.

Location 2: Northern Segment: Intersection of King Street at Louisiana Avenue / Moody Street

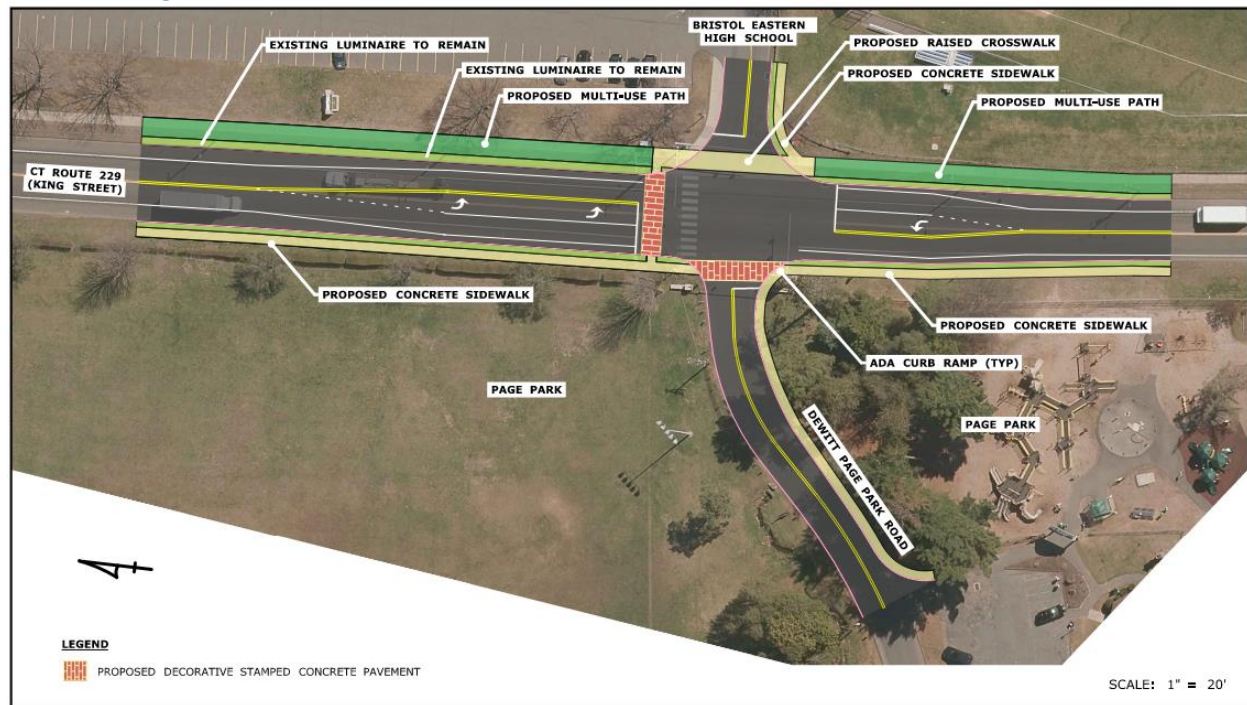


Location 2: Spot Improvement: Intersection of King Street at Louisiana Avenue / Moody Street

Currently, all intersection approaches are served by one shared lane for all movements. Four crosswalks are provided; however, sidewalk is only available on the east side. This location has been identified with higher crash rates and a fatal injury.

Due to high travel demand, the recommended improvements propose left-turn lanes at King Street and Louisiana Avenue to accommodate the expected traffic growth increased turning volume. The concept also incorporates the multi-use trail and sidewalk extension on either side of the roadway to provide safe travel and crossing for school children and park users. To the north of the intersection, school zone signage is proposed to identify clearly the sensitive area of school kids crossing the road. [Location 2](#) illustrates the redesign of the intersection to addresses the safety of all users.

Location 3: Northern Segment: Intersection of King Street at Page Park / Bristol Eastern High School

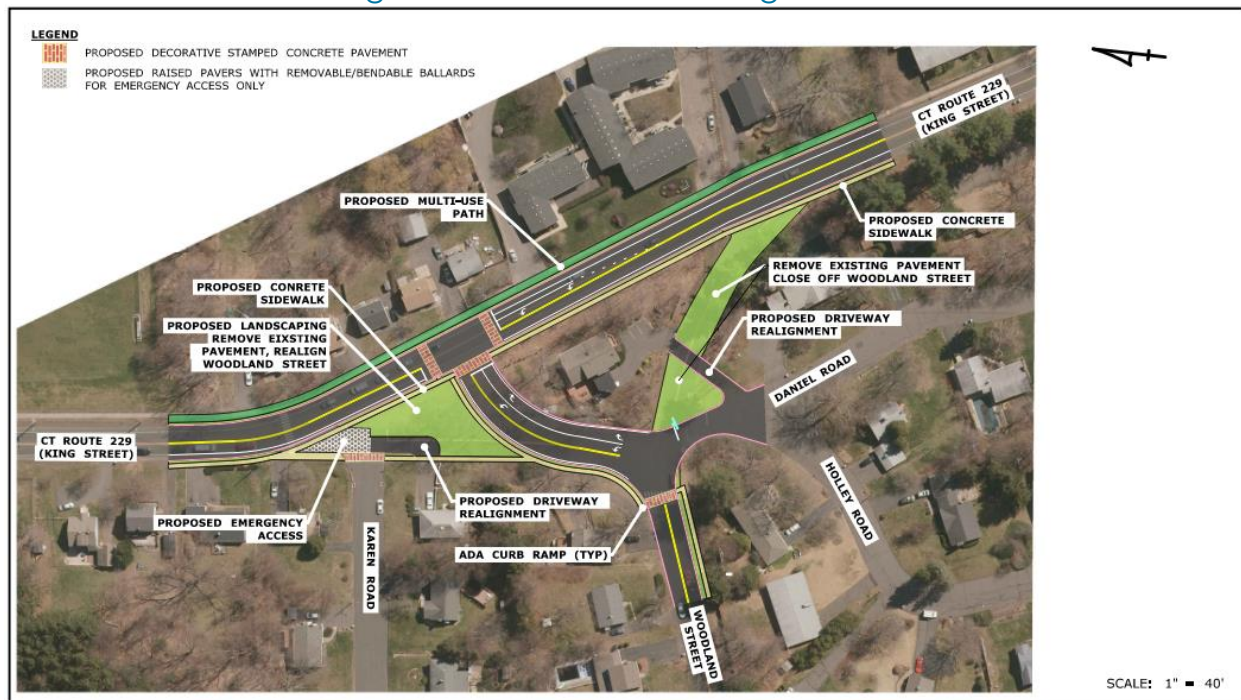


Location 3: Spot Improvement: Intersection of King Street at BEHS / Page Park

Location 3 was selected based on the high crash rates, failing intersection operations, and lack of amenities to ensure a complete street design that better services: school children, bicyclists, motorists, and transit riders of all ages and abilities. The proposed design includes a multi-trail on the east side and a continuous sidewalk on the west side of King Street. The sidewalk on the crossing roads continues into the two public properties: Page Park and BEHS with additional lighting, ADA ramps, and crosswalks. The sidewalk on the west side is extended into the Page Park parking lot to complete the connection to the playground to ensure safe passage for children and guardians alike. Exclusive left-turn lanes have been proposed to address the high frequency of intersection crashes and specifically those including left-turning vehicles.

The pedestrian phase time allocation will be left unchanged; however, all pedestrian phases were changed from exclusive to concurrent.

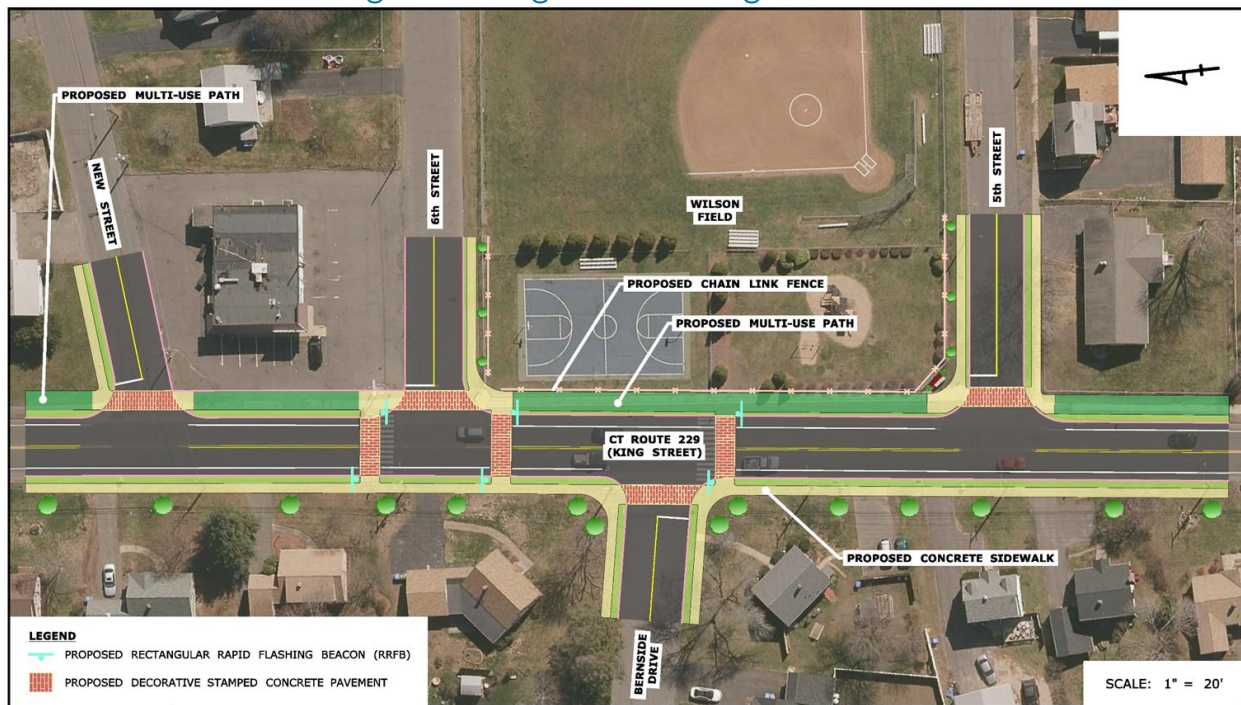
Location 4: Northern Segment: Intersection of King Street at Woodland Street



Location 4: Spot Improvement: Intersection of King Street at Woodland Street

Location 4 illustrates improvements at the intersection with Woodland Street. The redesign of the intersection includes changes to several approaches other than the signalized intersection of Woodland Street at King Street. To start, the southern unsignalized Woodland Street approach would be closed off and a piece of the roadway segment will be maintained to provide access to private driveways. The signalized Woodland approach will be realigned to resemble a “T-intersection” with a two-lane approach, an exclusive left, and an exclusive right-turn lane. The northbound approach of King Street would have a one through lane with an exclusive left-turn lane, while southbound would only have one through-right shared lane. Because of the realignment of Woodland Street, Karen Road is proposed to be closed off to through traffic, however, with paved access for emergency vehicles. Bollards and raised roadway are proposed at the existing Karen Street connection. The 495 Woodland Street driveway would be realigned to connect via Karen Road. Both sidewalk and multi-trail will continue on King Street as outlined in other sections. The 480 Woodland Street property will also have a realigned driveway, and along King Street edge a sidewalk with low height retaining wall might be necessary to stabilize the ground.

Location 5: Northern Segment: King Street Through Residential Area



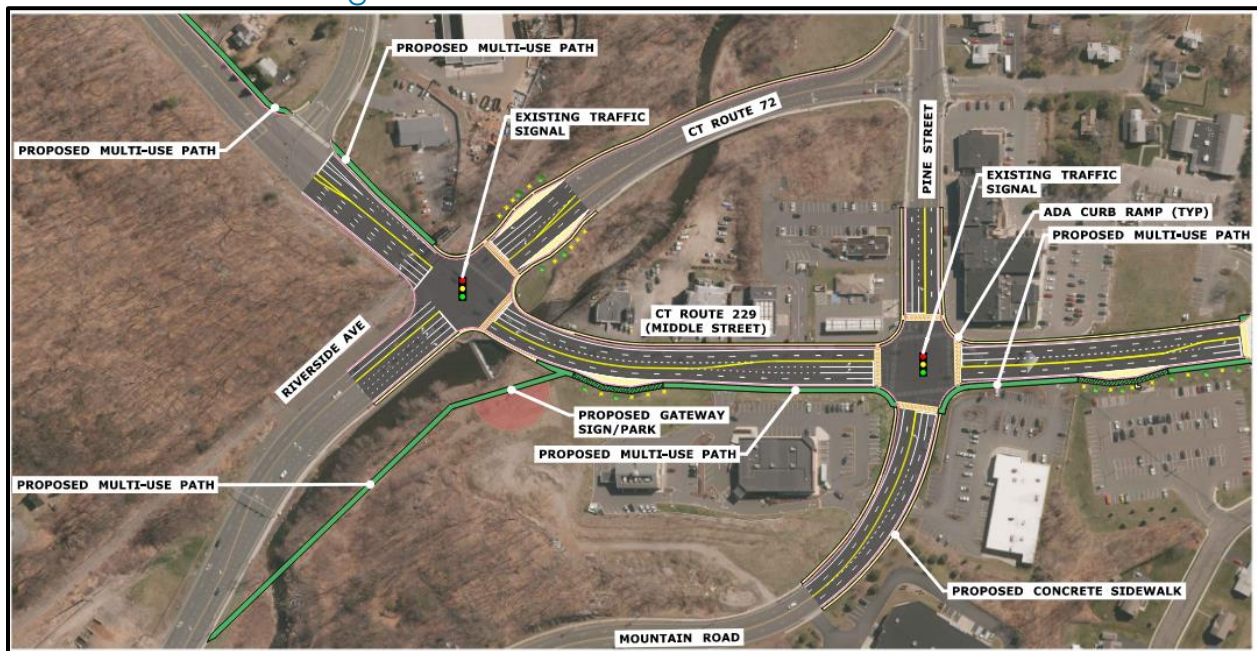
Location 5: Northern Segment: King Street Through Residential Area

Location 5 illustrates a proposed redesign of the CT Route 229 / King Street segment near the residential area to address safety concerns and multi-modal accommodations. From Farmington Avenue traveling southerly to First Street a continuous sidewalk on the west side of King Street and a multi-use path along the east side are proposed. At present, a sidewalk gap is present between 6th Street and West Washington Street on the east side, while on the west side there is no sidewalk. Local residents participating in the project outreach efforts, including the survey, expressed strong support for expanding sidewalk infrastructure in the study area, a total of approximately 1.5 miles along the northern segment.

Sidewalks should be a minimum of 5-feet wide, with a preferred width of 6-feet where space allows. Given the traffic speed and traffic volume on CT Route 229, sidewalks should be offset from the edge of the roadway to the greatest extent possible, preferably 4 feet or more where space allows. This separation from vehicular traffic provides pedestrians with a sense of comfort when traversing the sidewalk. The separation area also provides space for snow storage and landscaping when appropriate.

Crosswalk facilities should be expanded as pedestrian infrastructure is expanded in the study area. The recommended locations for new crosswalks at the intersections, based upon the proposed sidewalk network. The recommended locations for new crosswalks, based upon the proposed sidewalk network, include the earlier illustrated [Figure 39](#) and [Figure 40](#).

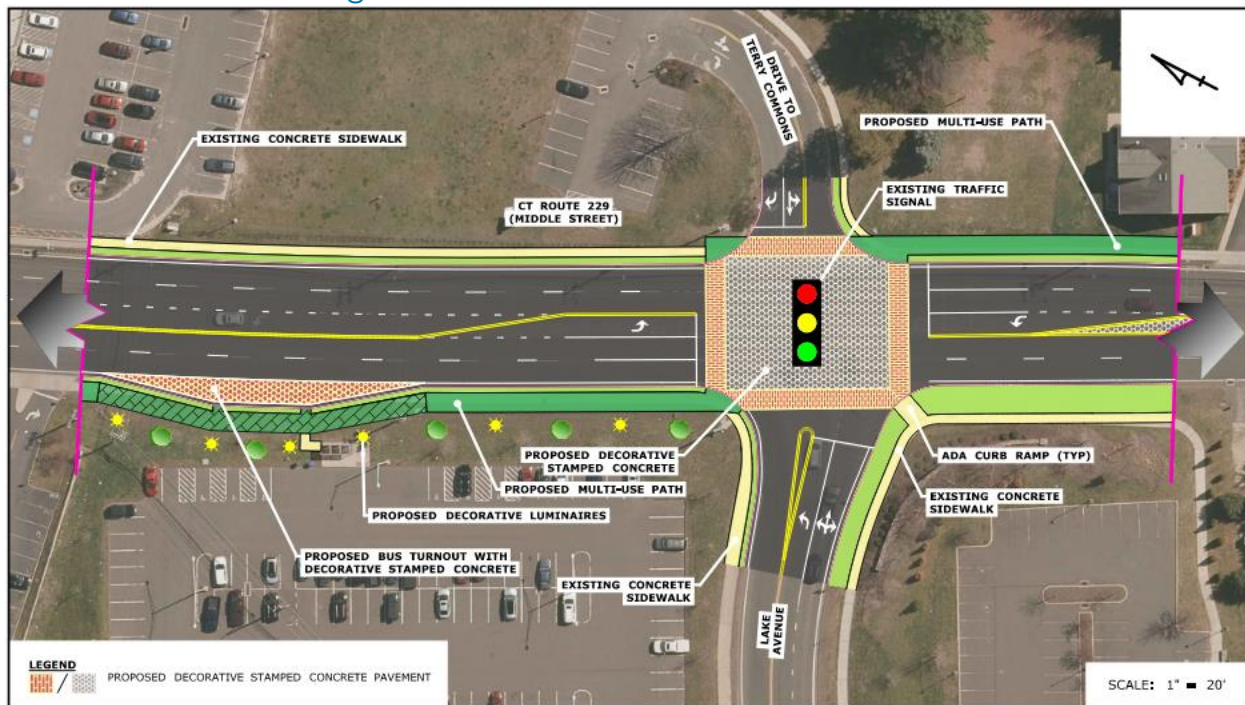
Location 6: Central Segment: Trident



Location 6: Spot Improvement: Intersection of Middle Street at Trident

The design of **Location 6** includes improvements on the adjacent Route 72 Extension and Riverside Avenue. The area experiences high volumes and a high number of crashes, thus, potential future growth will exacerbate both existing traffic congestion and safety issues. To improve the area's performance, a few seemingly minor strategies are suggested that, in combination, will improve the area as a whole. All pedestrian crossings and vehicle stop bars will be shifted a few feet away from the center of the intersection to lessen the distance the pedestrians would cross, thus shortening the pedestrian phase of the signal timings. All signal timings will be optimized, and as mentioned earlier, the pedestrian phase will change from exclusive to concurrent, thus increasing the vehicle phase. The proposed alignment of the multi-use trail will cross over to the east side of Middle Street from the Lake Avenue intersection to the Riverside Avenue intersection as there is more right of way available for the 10-foot-wide trail and it provides a better connection with the City of Bristol proposed City-wide bike network. The proposed multi-use will additionally pass through a small green space in the currently vacant lot south of the Bristol Brass Dam along the Pequabuck River. This space may also be a good location for gateway signage and pedestrian amenities, including benches, a gazebo, pedestrian lighting, fountains, and beds full of native plants. The trail would continue along Riverside Avenue and connect with the extension of the city-wide bike network along Memorial Boulevard. Also, on the southwest corner of the Riverside Avenue intersection, a new bus stop with bus pull out is proposed. The bus stops in the Trident area are designed to better serve the newly proposed and edited bus routes as described in the Transit Enhancements section.

Location 7: Central Segment: Intersection of Middle Street at Lake Avenue



Location 7: Spot Improvement: Intersection of Middle Street at Lake Avenue

Location 7, has a proposed a multi-use trail that will shift from the west side of the road to the east side at the intersection crossings. There is an existing sidewalk on both sides of the road; however, on the west side, the sidewalk terminates at the parking lot for Casey Field. This concept proposes to extend the sidewalk to the south thus providing a continuous connection for pedestrians accessing Casey Field or commercial businesses to the north. The existing park-and-ride lot on the northwest corner of the intersection will be maintained and enhanced with street-side bus turnouts, bus shelters and other amenities to provide a full build-out bus stop. The multi-trail alignment will run behind the bus station on Middle Street with pavement and sign markings to ensure "conflict areas" are identified. The Lake Avenue intersection concept also includes an imprinted textured pavement as a traffic calming and aesthetic treatment for existing crosswalks. Note, the Compounce Ridge Trail, a component of the Tunxis trail network, starts at the park-and-ride lot and continues southwesterly off road through woodlands by Lake Compounce Theme Park where it connects with Bobcat Trailhead.

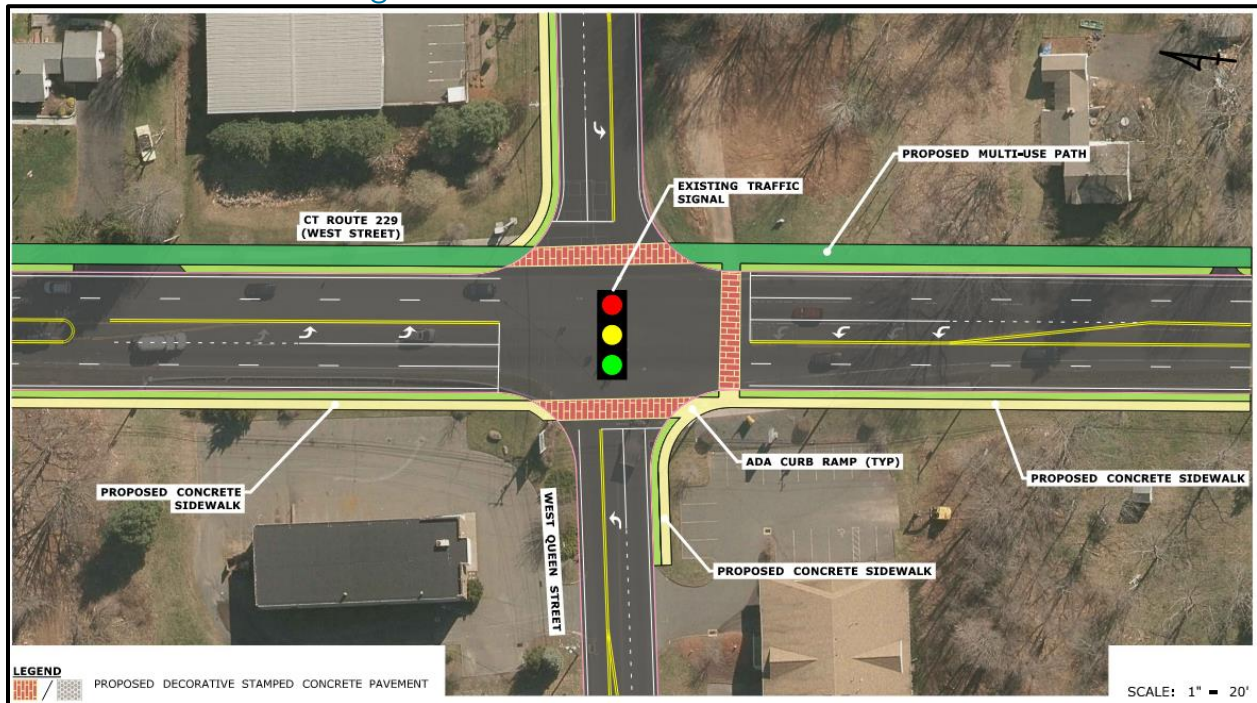
Location 8: Southern Segment: West Street Segment from Townline Southerly



Location 8: Segment Improvement: West Street from Townline Southerly

Location 8 stretches from ESPN Drive in the southerly direction to the Executive Boulevard South intersection. The existing condition includes a lane drop in the southbound direction which leads to congestion during peak hours. This conceptual improvement addresses the potential for congestion by continuing two through in the southbound direction while maintaining the existing two lanes in the northbound direction. In addition to this improvement, the multi-trail has been included on the east side of the road and a sidewalk on the west side. The widening of the roadway in the southbound direction and provisions for the new sidewalk and multi-use trail may require expansion of right-of-way.

Location 9: Southern Segment: Intersection of West Street at West Queen Street



Location 9: Spot Improvement: Intersection of West Street at West Queen Street

Location 9 has a proposed a multi-use trail on the east side of the road and a sidewalk on the west side to accommodate pedestrians and cyclists. For the vehicle traffic, the two proposed through lanes in the southbound direction are maintained in addition to the existing two through lanes in the northbound direction. The exclusive left turn lanes on CT Route 229 are preserved and exclusive left turn lanes on West Queen Street are added. The proposed left turn lanes are to address the high frequency of intersection crashes and specifically those including left-turning vehicles. Crosswalk facilities are expanded along with pedestrian infrastructure. The recommended locations for new crosswalks at the intersections, include two parallel to the CT Route 229 and one crosswalk across the corridor to the south of the intersection, are seen in the image above. Additional considerations should be made for West Queen Street as an east-west connection with a proposed extension of Farmington Canal Heritage Trail (FCHT). Extension of the FCHT into northern Southington and Plainville, as proposed by the Gap Closure Study, can be expected to result not only in substantial increases in trail use in Plainville and Southington but also additional pedestrian and bicycle travel to and from the FCHT on cross streets, such as West Queen Street.

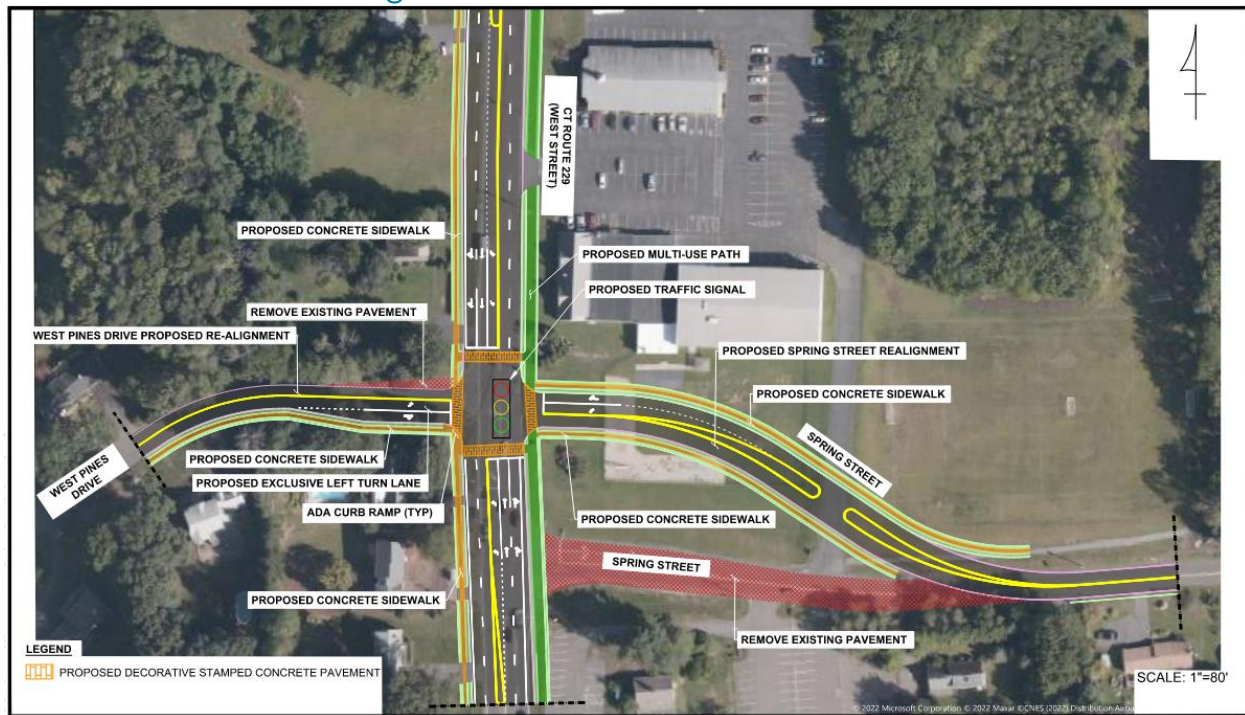
Location 10: Southern Segment: Intersection of West Street at Welch Street



Location 10: Spot Improvement: Intersection of West Street at Welch Street

Location 10 was selected based on the high crash rates, future failing intersection operations, and lack of amenities to ensure a complete street design. The proposed design includes a multi-trail on the east side and a continuous sidewalk on the west side of West Street. The sidewalk on the crossing road connects to existing sidewalk on the south edge of Welch Street. An exclusive left-turn lane and right-turn lane were stripped on Welch Street within existing roadway width. The two proposed through lanes in the southbound direction are maintained in addition to exclusive turn lanes into Welch Street were added

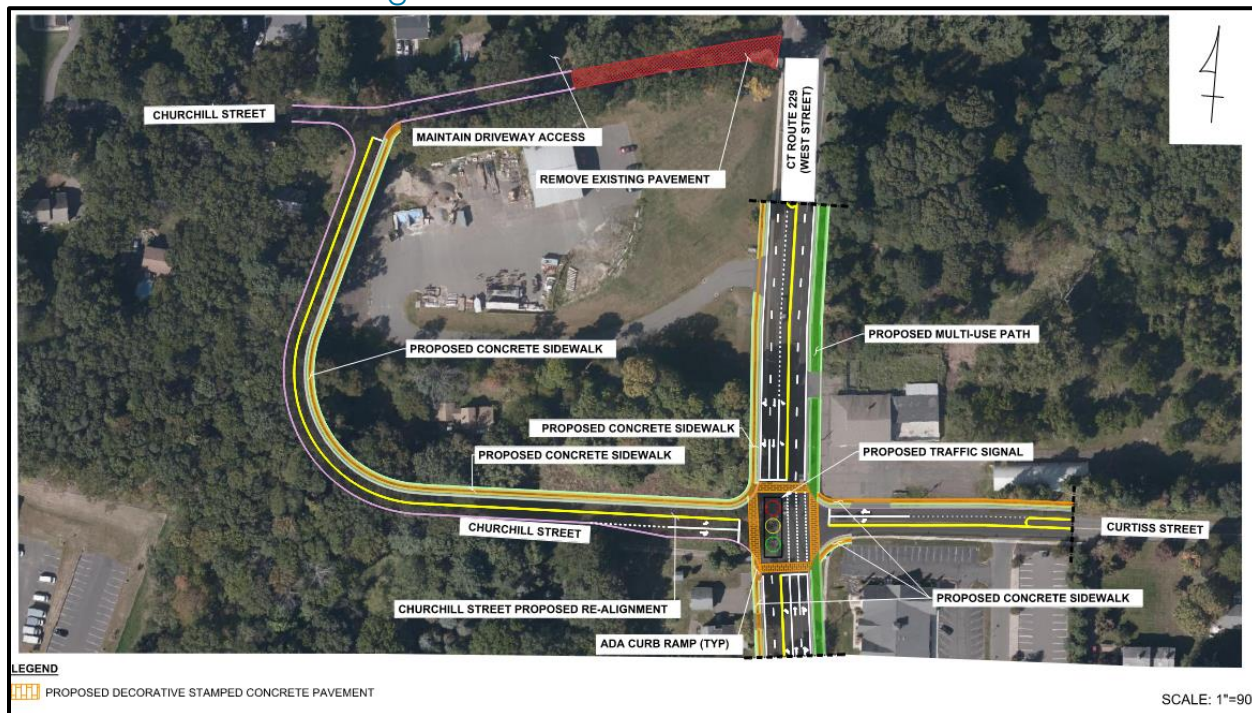
Location 11: Southern Segment: Intersection of West Street at West Pine Street



Location 11: Spot Improvement: Intersection of West Street at West Pines Drive

Location 11 was redesigned with the assistance of the Town of Southington. A full build-out scenario includes realignment of Spring Street to eliminate the partially signalized offset intersection created by West Pines Drive and Spring Street and replace it with a more desirable 4-leg signalized intersection. West Street southbound will continue with two lanes south of the proposed intersection, similar to the northbound direction. All approaches will receive exclusive left-turn lanes, due to high left-turn volumes. Since the realignment of a roadway is an expensive long-term solution in regard to property acquisition and construction cost, two alternatives may be considered. Alternative-1 is to provide “Don’t Block the Box” pavement markings and associated signage in the West Pines Drive intersection to avoid the potential for southbound signal que backing up into the West Pines Drive intersection and obstructing the northbound left-turn into West Pines Drive. Alternative-2 is to install a traffic signal at the West Pines Drive intersection which must be made part of the coordinated signals along West Street.

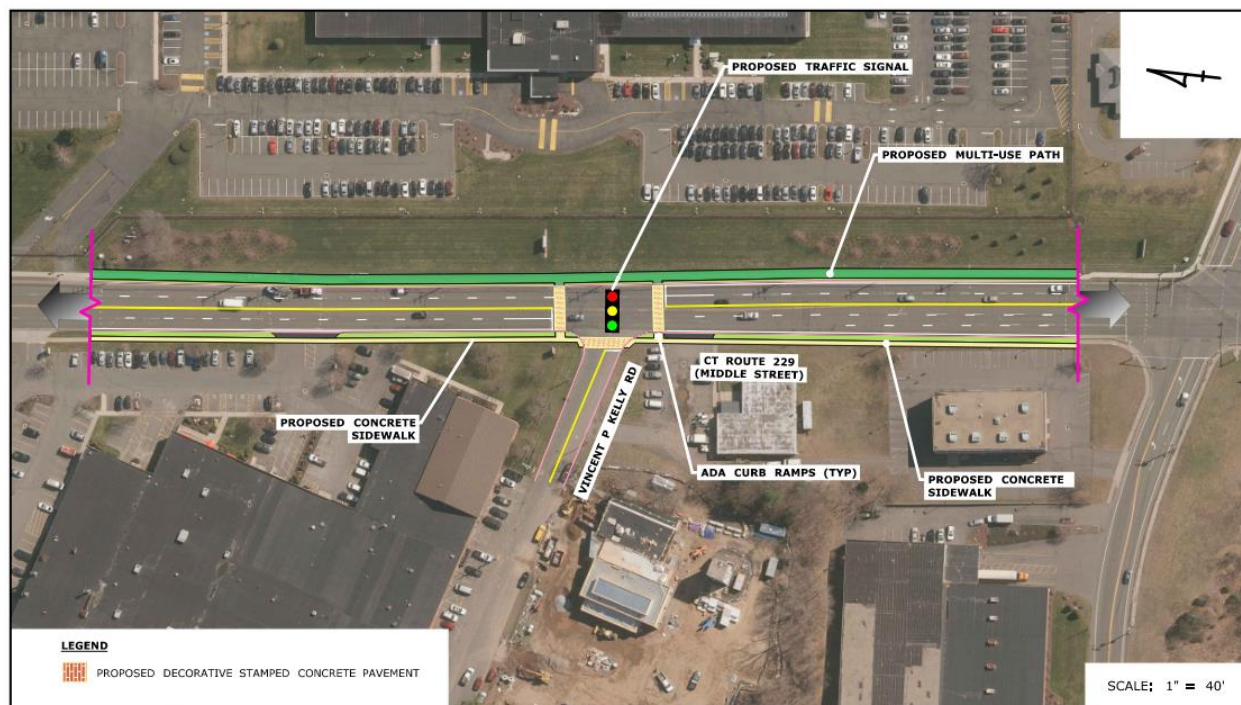
Location 12: Southern Segment: Intersection of West Street at Churchill Street



Location 12: Spot Improvement: Intersection of West Street at Churchill Street

Location 12, similar to **Location 11**, was developed with assistance from the Town of Southington. Curtiss Street is an existing signalized T-intersection with a sidewalk available only on the southeast corner. Churchill Street is a closely spaced intersection approximately 600 ft to the north. The goal of this concept is consistent with the overall approach to the corridor to minimize the number of intersections and eliminate closely spaced intersection while providing overall access control over Route 229. The full build-out scenario includes realignment of Churchill Street to the south to connect to West Street opposite of Curtiss Street. The proposed improvement will include a sidewalk along the west side and multi-use trail along the east side of West Street and a sidewalk along the east side of the realigned Churchill Street. Due to high left-turn volumes, all approaches have been provided with an exclusive left-turn lane. It should be noted, a recently proposed development along Churchill Street will be build and the changes to the intersection will better accommodate the increased traffic from/to Churchill Street.

Location 13: Central Segment: Intersection of Middle Street at Vincent P Kelly Road



Location 13: Spot Improvement: Intersection of Middle Street at Vincent P Kelly Road

Location 13 was selected at the request of the City of Bristol and the public to determine if signalized intersection would be warranted. Vincent P Kelly Road, although it is a local street with one lane in each direction, serves the City with several services such as Bristol Animal Control, Bristol Public Works, and the Bristol Fire Department Engine Co. No.4, which occasionally hosts community events. To justify a signal-controlled intersection, Warrant 1 of 9 was analyzed. Warrant-1 is based on eight-hour vehicular volume with two conditions. Condition-A: minimum vehicular volume, is intended for application where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal. Condition-B, interruption of continuous traffic, is intended for application where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street. Warrant-1 is met if the requirements for Condition-A or Condition-B are fulfilled for any eight hours of an average day or if a Combination of Warrants, 80% of Condition-A and 80% of Condition-B, is fulfilled for any eight hours of an average day. Utilizing Streetlight data, Warrant-1 analysis was performed. Warrant-1 is not satisfied for Condition-A but met for Condition- B. There are four hours out of eight required for Condition-A and twelve hours met for Condition-B. Further analysis with additional warrants and new traffic count data is necessary for CTDOT approval.

An extenuated circumstance can be given to this location with the Bristol Fire Department Engine Co. No. 4. A proposed signal could be installed with yellow flashing for Middle Street approaches and red flashing at Vincent P. Kelly Road. Only when the controllers detect an approaching firetruck or ambulance will it automatically switch traffic lights to green from

flashing red to give them a clear path through an intersection. Similarly, adaptive signal control technology (ASCT) being installed throughout the State of Connecticut could be utilized for more responsive changing traffic conditions. ASCT are designed to accommodate the rise and fall of volumes through the peaks and the changing patterns of flow throughout the day and week. For example, during commuter peaks, the primary objective may be to maximize the throughput along the road in the peak direction. Then during business hours, the objective may be to balance delays between traffic associated with the adjacent activity and traffic simply traveling through the system.

Implementation

The implementation plan identifies and prioritizes recommended improvements that can be planned, programmed, and built as funding becomes available and project need is realized. The implementation plan includes the overall project costs, complexity, and benefit. This section of the report seeks to provide the City of Bristol and Town of Southington, CTDOT, and NVCOG a menu of projects with guidance for implementation over time based on a series of qualitative and quantitative metrics.

The Transportation Improvement Program (TIP) has been established to address the roadway network, transit system, and pedestrian and bicycle mobility and safety needs in the study area. The TIP recommends physical roadway improvements and identifies numerous improvements to enhance pedestrian, bicycle, and transit access to the roadway system through construction of new and improved facilities for alternative modes of travel. The program projects can be classified as small, medium, and large based on project size, complexity, and project cost. The projects are also prioritized as short-term, mid-term, and long-term to represent when implementation of the project is anticipated. A short-term project prioritization indicates an immediate need for the project to address an existing deficiency or operational concern. Conversely, a project prioritized as long-term is intended to address an anticipated future issue or need such as operational issues that are expected to occur due to future traffic growth. **Table 21** provides additional information related to the project type categorization metric utilized in the TIP.

Table 21: TIP Project types

Project Type	Implementation Time	Complexity	Approximate Project Cost
Small	Less than 3 years	Low	Less than \$1 million
Medium	Between 3-6 years	Moderate	\$1 million - \$2 million
Large	More than 6 years	High	More than \$2 million

Project costs have been estimated following the guidelines published by the Connecticut Department of Transportation and are presented in 2021 dollars. Project costs may require inflation factors looking out into the future to determine actual funding needs for funding programming. The "Preliminary Cost Estimating Guidelines" provide unit costs and percentage based lump sum costs to facilitate the estimation of project costs at the Preliminary Engineering level of project development. The approximate project costs presented in this Study are limited to the construction item costs and exclude costs related to rights of way actions and environmental remediation and engineering. The estimates include minor items (25%), contingency (20%), and incidentals (20%) in the total opinion of probable costs for each major construction item. The estimate was made by segment with highest cost in the Southern segment, where two new realigned intersections are proposed at a total cost of \$9.7M, followed by central segment with \$3.5M that includes estimate of

one signalization of intersection and transit amenities, and last Northern segment with a total cost of \$1.9M. More detail breakdown is provided in [Table 22](#).

Table 22: Project Cost Estimate

Segment		Miles	LF	Unit Cost	Cost
Sidewalk	Northern Segment	1.5	7920	\$15/SF	\$ 594,000
	Central Segment	2.3	12144	\$15/SF	\$ 910,800
	Southern Segment	2	10560	\$15/SF	\$ 792,000
		* Assume 5' sidewalk			
Segment		Miles	LF	Unit Cost	Cost
Multi-trail	Northern Segment	1.5	7920	\$50/SY	\$ 440,000
	Central Segment	2.3	12144	\$50/SY	\$ 674,700
	Southern Segment	2	10560	\$50/SY	\$ 586,700
		* Assume 10' wide Multi-trail			
Segment		Count	SF	Unit Cost	Cost
Crossings	Northern Segment	9	3600	\$30/SF	\$ 108,000
	Central Segment	12	7680	\$30/SF	\$ 230,400
	Southern Segment	14	10080	\$30/SF	\$ 302,400
		* Assume Stamped Bituminous Crosswalk			
Segment		Count		Unit Cost	Cost
Transit Amenities	Northern Segment	0		\$15,000/Each	\$ -
	Central Segment	12		\$15,000/Each	\$ 180,000
	Southern Segment	10		\$15,000/Each	\$ 150,000
		* Assume various solutions along the corridor but cost estimate based on shelter with bench, trash cans, bike rack, variable sign, etc.			

	Segment	Count		Unit Cost	Cost
Gateway Signage	Northern Segment	4		\$10,000/Each	\$ 40,000
	Central Segment	6		\$10,000/Each	\$ 90,000
	Southern Segment	4		\$10,000/Each	\$ 60,000
* Assume various solutions along the corridor but cost estimate based on shelter with bench, trash cans, bike rack, variable sign, etc.					

	Segment	Count		Unit Cost	Cost
Signal	Northern Segment	0		\$450,000/Each	\$ -
	Central Segment	1		\$450,000/Each	\$ 15,000
	Southern Segment	2		\$450,000/Each	\$ 30,000
* Assume locally owned adaptive signal control technology (ASCT)					

	Segment	Count		Unit Cost	Cost
Intersection Redesign	Northern Segment	0			\$ -
	Central Segment	1 *		\$350,000/Each	\$ 350,000
	Southern Segment	2 **		\$2000,000/Each	\$ 4,000,000
* Assume design and construction of the Pine St./Mountain Rd. @ Middle St. * Assume design and construction of the realigned two intersections.					

Segment	Total Cost
Northern Segment	\$ 1,182,000
Central Segment	\$ 2,450,900
Southern Segment	\$ 5,921,100

The majority of the recommendations and improvements identified in this Study will be publicly funded through State and/or Federal Transportation Funding Programs as provided for in the Federal Transportation Legislation, through State funding made available in the State of Connecticut transportation budget, or through the State Bond Commission. However, there are other improvements that could be constructed by private entities as mitigation for proposed development in the study area. The municipalities should rely on the recommendations of this Study to ensure that local regulatory approvals consider † the

appropriate level of mitigation be included as a condition of approval of new development. There are many current funding sources to support the recommendations presented in the Study. Current funding programs include:

- Community Connectivity Grant Program (CCGP)
- Congestion Mitigation and Air Quality Improvement Program (CMAQ)
- Local Capital Improvement Program (LoCIP)
- Local Transportation Capital Improvement Program (LOTICIP)
- National Highway Performance Program (NHPP)
- Highway Safety Improvement Program (HSIP)
- Local Road Accident Reduction Program (LRARP)
- Recreational Trails Program
- Special Tax Obligation Bonds
- Surface Transportation Program (STP)
- Transportation Alternatives Program (TAP)

It is worth noting that with any program reliant on public funding, either by the Federal Government or State of Connecticut, priorities may change in the future along with available funding for transportation system improvements. In addition, there are several large construction projects currently underway and in design in the State of Connecticut that can constrain transportation spending looking forward as available funds are channeled to complete these projects. The State of Connecticut Department of Transportation published the “Transportation Infrastructure Capital Plan: 2021 – 2025” describing the state of available funds and programmed spending over the next few years. However, the current fiscal constraints should not limit the identification and pursuit of projects and funding for the priority projects identified by the Study so that as funding becomes available, projects are ready.

On November 15, 2021, the Congress and President Joe Biden signed into a law the Infrastructure Investment and Jobs Act (IIJA) (H.R. 3684), commonly referred to as the Bipartisan Infrastructure Bill. The IIJA would provide about \$1 trillion to programs across federal agencies. In addition to major investments in roads, bridges, railways, and public transit, the bill includes funding for broadband internet access, water and wastewater infrastructure, electric vehicle charging stations, clean transportation, and carbon capture efforts.

Interim Design Strategies

Interim design strategies are a set of tools and tactics that communities can use to improve their roadways and public spaces in the short-term. With limited funding streams, complex approval and regulatory processes, and lengthy construction timetables, municipalities are often challenged to deliver the results that communities demand as quickly as they would like. Interim materials or phased solutions provide opportunities to quickly demonstrate change, at a lower cost, and are therefore more easily approved. Before and after comparisons reveal solutions that work and ones that don't. Some cities brand the interim design as a pilot or test phase for a project, and others view the design as equivalent to

permanent reconstruction. In some parts of the United States, it is also referred to as Tactical Urbanism or Quick-Build Projects.

Whether setting a parklet along a curb, pedestrianizing a narrow corridor, or redesigning a complex intersection, communities have the opportunity and the responsibility to make the most efficient use of valuable street space. An interim design can serve as a bridge to the community, helping to build support for a project and test its functionality before going into construction. The Quick-Build Projects also provide a formal process by which residents can request the installation of traffic-calming measures in their neighborhood.

In the CT Route 229 Corridor few areas and the proposed designs could be implemented utilizing the flexible materials, but durable enough to provide the time, political capital, and budget to evaluate and iterate upon the initial design. These include the restriping of the corridor to include turn lanes, painted crosswalks with murals and or extended curbs, dedicated painted bus stop zones and many more.

Community Crosswalk Program

Specially designed crosswalks that are painted or otherwise showcase art can be an effective way to encourage community involvement in pedestrian safety issues and to promote safe crosswalk behaviors. Neighborhoods can collaborate to design a unique crosswalk that represents the best parts of that community and clearly highlights a safe pedestrian walking path. However, please note that these types of decorative crosswalks are not compliant with the Manual on Uniform Traffic Control Devices (MUTCD) and generally are not supported by the Federal Highway Administration (FHWA). While they may bring attention to the crosswalk and make pedestrians more aware of educational or enforcement programs, if not designed properly they may negatively impact safety.

Upgrades to Unsignalized Crossings

Other unsignalized pedestrian crossing upgrades can be implemented outside of a detailed engineering study. For example, Rectangular Rapid Flashing Beacons (RRFBs) are flashing lights designed specifically to draw drivers' attention to a pedestrian crossing sign. The pedestrian pushes a button to activate the system that includes rectangular-shaped yellow LED lights that are extremely bright (even in daylight) and flash with rapid frequency. The CTDOT screen locations statewide to systemically identify unsignalized midblock crosswalks that could benefit from RRFBs. The projects are being administered by the State in collaboration with municipalities.

Upgrades to Signalized Intersections

In addition, two focus areas Location 9 and Location 10 could be completed with an interim step. For example, to the north of West Pines Street intersection provide an additional pavement marking such as "Do Not Block Intersection" and solid crosshatch lines to ensure access to West Pines Street from northbound is provided.

School Zone

Lastly, the school zone implementation could be permitted and constructed under the interim design strategies. All school warning signs could be replaced under the statewide

program with highly reflective yellow-green signs to enhance visibility, especially during dawn and dusk periods.

Radar Speed Signs

Also, radar speed signs (also known as driver feedback signs) could be implemented throughout the corridor and specifically in the northern segment to display the driver's speed. These signs are used as quick and inexpensive measure of traffic calming device designed to slow vehicular speeds by alerting drivers of their speed.

Engineering Design

Following the initiation of a project and identification and approval of a funding source, the remaining steps to implement an improvement will involve design and construction. Based on the complexity of a project, an initial Preliminary Engineering phase may be required to conduct a more detailed engineering study and refine the concept plans and project scope. A preliminary engineering study can help establish the potential impacts to environmental and natural resources, identify potential property and utility impacts, and help refine the expected costs in current dollars rather than forecasting based on estimates reported in this Study, which are provided in current 2021 dollars.

Once Preliminary Engineering is complete and the decision is made to move forward with a project, Final Design will take place to add detail to the plan, prepare the necessary permits, conduct a right-of-way acquisition process, coordinate with utility companies to address utility conflicts and possible relocations, and develop construction documentation to facilitate bidding and construction of the improvements. Generally, projects that are identified as having a low level of complexity can be designed within 12-18 months from initiation of the project. As complexity grows, so does the timeframe required to design improvements. Design phases can potentially last three years or more for highly complex projects.

Green Infrastructure and Landscaping Recommendations

Corridor improvement should be accompanied by green infrastructure and landscaping including trees, median island plantings, and low impact design (LID) techniques that minimize stormwater runoff and mitigate against the expansion of impervious surface associated with roadway widening and construction of sidewalks and paved multi-use trails. The provision of landscaping with roadway improvements will also seek to preserve the character of the study area.

Green infrastructure refers to innovative stormwater management practices and technologies that capture, infiltrate, filter, evaporate, and reuse stormwater to maintain or restore natural hydrology. This is achieved by managing the quantity and quality of stormwater runoff from streets (green streets) and development sites (low impact developments) at points that are as close as possible to the sources of the runoff.

Given the proximity of the Pequabuck River and Eightmile River, and its floodplains, green infrastructure practices should be incorporated into the subsequent planning, design, and construction of future improvements to CT Route 229, local streets, and new private development sites, particularly within the future development nodes where the surface area of new and potentially impervious rooftops, parking, and street surfaces will be greatest. The implementation of green streets and low impact development practices should be consistent with current CTDOT, NVCOG, and CRCOG policies.

Potential Prioritization

Table 23 on the following page summarizes the implementation plan recommendations. Sidewalks through northern segment and all proposed crossing locations have identified as high priority with Short-Term implementation schedule. Majority of the remaining proposed recommendations fall into medium priority with short to mid-term implementation. Redesign of signalized intersections, being costly and complex, have been categorized with long-term implementation.

Table 23: Project Prioritization

	Segment	Priority	Implementation	Complexity	Cost
Sidewalk	Northern	High	Short-Term	Low	\$594,000
	Central	Medium	Mid-Term	Low	\$910,800
	Southern	Medium	Mid-Term	Low	\$792,000

	Segment	Priority	Implementation	Complexity	Cost
Multi-trail	Northern	Low	Long Term	Moderate	\$440,000
	Central	Low	Mid-Term	Moderate	\$674,700
	Southern	Low	Long Term	Moderate	\$586,700

	Segment	Priority	Implementation	Complexity	Cost
Crossings	Northern	High	Short-Term	Low	\$108,000
	Central	High	Short-Term	Low	\$230,400
	Southern	High	Short-Term	Low	\$302,400

	Segment	Priority	Implementation	Complexity	Cost
Transit Amenities	Northern	-	-	-	-
	Central	Medium	Mid-Term	Low	\$180,000
	Southern	Medium	Mid-Term	Low	\$150,000

	Segment	Priority	Implementation	Complexity	Cost
Gateway Signage	Northern	Low	Mid-Term	Low	\$40,000
	Central	Low	Mid-Term	Low	\$90,000
	Southern	Low	Mid-Term	Low	\$60,000
	Segment	Priority	Implementation	Complexity	Cost
Signal	Northern	-	-	-	-
	Central	Medium	Mid-Term	Moderate	\$15,000
	Southern	Medium	Long-Term	Moderate	\$30,000
	Segment	Priority	Implementation	Complexity	Cost
Intersection Redesign	Northern	-	-	-	-
	Central	Medium	Mid-Term	High	\$350,000
	Southern	Medium	Long-Term	High	\$4,000,000

Following the completion of the design phase, the projects will begin the construction phase. The steps involved in a publicly funded project include advertisement for bids to contractors, collecting bids on the work and awarding the contract, and finally conducting the construction to build the improvement. Utility relocations typically take place during construction, but in some instances a utility company may relocate facilities in advance of a project taking place once a utility agreement is in place. Generally, smaller projects are completed within one construction season between March and November. Larger projects can span several construction seasons depending on the complexity of the work, the construction staging and phasing needed to facilitate the maintenance and protection of traffic operations during construction, and possibly the availability of funding. Projects identified as having Moderate Complexity can be expected to take up to two construction seasons and highly complex projects could take more than two construction seasons to build.

APPENDIX

Appendix A Streetlight Data Traffic Counts

Appendix B Summary of Crash Data

Appendix C Fatal Crash Summary

Appendix D Hazardous Risk Site

Appendix E ADA Compliance

Appendix F Stakeholder Information

Appendix G Public Survey

Appendix H Real Estate Market Analysis

Appendix I Synchro Capacity Analysis Files

Appendix J Renderings

Appendix K Cross-Sections

Appendix L Response to Comments